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THE GREAT ONTARIO TRANSMISSION.

We close with this week the series of articles dealing with the great transmission system now in operation in the Province of Ontario. It has many features of interest that appeal to our readers. First of all, it is by far the most considerable transmission system operating at extreme voltage. Transmission at 100,000 to 110,000 volts is sufficiently well established to call in itself for no particular comment. The Ontario plant, however, with 281 miles of high-tension distribution at this particular pressure, stands alone in magnitude. It is also noticeable in that the work has been done under the immediate control of a government commission, which supplies at cost electrical energy to twenty-nine municipalities, and has been put through to completion for less than the estimated cost. Whatever may be one's personal opinions about the desirability of municipal ownership, it must be granted that this feat of public distribution is altogether out of the ordinary. Commission rule seems in this particular instance to have been a shining success. It will be interesting to ascertain later the actual cost of the delivered energy to the various municipalities, including proper provision for the upkeep of the transmission system. The price paid for power from the busbars of the Ontario Power Company is so low, $9.40 per hp per year, that, even considering the great length of transmissions and the cost of the equipment, the net expense per kw-hour to the purchasing municipalities must be remarkably small.

The line presents no extraordinary features except the low cost of construction as actually found. Much of the line construction is of double-circuit towers, and both these and the single-circuit towers are carefully worked out on somewhat well-known lines. The right-of-way is a slightly unusual proposition in that easements were acquired by the commission giving full rights for thirty years with the right of renewal at the original price, or, if it should seem desirable, the right to settle by mutual agreement or arbitration. In this way no strip of land is actually taken up from cultivation, and the rights were therefore acquired much more cheaply than they would be in any ordinary case. The standard distance between towers, of 550 ft. in level country, is a conservative one, and towers seem to have been built throughout with ample allowance for the strains to which they are to be exposed.

As regards the line itself, the ordinary spacing of the wires is 9 ft. and the clearance of any line from the steel of the tower under the condition of maximum swing is 3 ft. 6 in., giving a safety distance between line and line of not less than 7 ft. The suspension insulators, with their eight sections and total weight of 100 lb., are fully adequate, as the experience of the past year has shown, to stand up well even under the extreme voltage used. They were

actually tested out for a factor of safety of three times the rated voltage when dry, and twice the rated voltage when under a precipitation of water of ½ in. a minute. This is a larger factor of safety than has customarily been allowed on high-tension service, and may fairly be considered adequate. One very rarely sees a factor of safety of 2 for an insulation under spray in transmission service. In lines constructed with pin-type insulators working up to, say, 60,000 volts this factor of safety is very seldom reached. Hardly any insulators of the ordinary type will hold up under a spray beyond 80,000 or 90,000 volts, and they will usually flash over considerably below 150,000 when dry. The added factor of safety in this installation means material improvement in reliability and approaches the value which one should consider as really sufficient to meet the needs of safety. The effectiveness of the insulation as actually installed was very well shown by tests carried up to 165,000 volts, at which enormous pressure operative conditions were still maintained. The initiation of this system was therefore marked by a material step upward in insulation, which may mean much to long-distance transmission in the future. So far as the line itself is concerned, it is interesting to note that, with the exception of 3 miles inside the city limits of Toronto, the whole system is of aluminum cable, seven-stranded, with an elastic limit of 14,000 to 15,000 lb. per sq. in. and an ultimate strength of nearly double this figure. The extensive use of aluminum cable in Canada and its small use here is an excellent example of the practical effect of a heavy protective duty on engineering operations. In stringing this cable the tensions were based on the theory that the cables might be stressed to the elastic limit only at the freezing point, with a ⅜-in. coating of ice and a 65-mile wind. This basis of strain is quite different from that used by many over-cautious engineers, who seem to think it necessary to take account of the biggest coating of ice they ever heard of, combined with the highest wind possible and the lowest temperature in the memory of the oldest inhabitant. These three adverse conditions are well known not to be practically concurrent, and the allowances made in these transmission circuits seem, therefore, to be fully sufficient.

The towers for lightning protection are equipped with 5/16-in. galvanized-steel ground wires connected directly to each tower. As many as three are employed on some of the double-circuit towers. Much interesting special work which is fully described in the papers was necessary, perhaps the most striking instance being the entrance into Toronto with the high-tension circuits, which includes a mile of line 200 ft. off shore in Lake Ontario and a continuation to the substation borne on towers giving 70 ft. minimum clearance between wires and earth. The low-tension distributions, aside from their number and extent, present no extraordinary features, most of them being at the familiar 13,000 volts. The system has now been in operation about fifteen months, beginning with the 100-mile transmission at 110,000 volts to Berlin, Ontario. The very important Toronto equipment has been in service nearly eleven months, and from all accounts the system has been singularly free from interruptions. The work of the commission is by no means done. It was charged with the duty of looking after the electrical interests of the Province and it is doing it with distinguished success. Contracts will be made with other powers than Niagara whenever it is feasible, and steps taken to supply the Province, which is rich in water-powers, with transmitted energy wherever it is necessary. It is a very big enterprise—in fact, the biggest yet undertaken on this continent. It has been fortunate in being able to avoid costly pioneering work, since the main principles of transmission at 100,000 volts had already been worked out elsewhere, but it has certainly made the most of the information already at hand and has carried through to its present stage a most important and successful work which will be continued to a far greater completion. Credit for this achievement is to be assigned to Hon. Adam Beck, chairman, and to Mr. P. H. Sothman, the very able chief engineer, of the commission.

COLOR PHOTOMETRY.

For the measurement of almost all physical quantities there have been developed instruments of various kinds which either determine directly the magnitudes of the quantities involved or allow a comparison to be made between the known and unknown quantities without depending upon the judgment of any human observer. An exception exists in the case of light, for the direct measurement of which there has as yet been devised no means, and for the comparison of which we must still rely on the processes of the human mind. Two methods are known for the direct comparison of the radiations with which light is closely associated, namely, the bolometric and the photographic. The former affords a good indication of the radiations toward the red and infra-red part of the spectrum, while the latter allows one to determine fairly well the radiations toward the violet end and beyond. The sensation of light is produced by radiations falling between and including the red and violet, so that neither of these methods serves to measure light, and even a combination of the two would be incomplete and unsatisfactory.

At the present time the only approximately satisfactory method of measuring light is by comparison with a standard of light. The only instrument for determining the comparison is the human eye, the photometer employed in carrying out the method being merely a device for adjusting the lighting effect obtained from one source until it equals that from another source as judged by the eye. When the eye considers that equality has been obtained an application of well-established laws relating to the variation of lighting effects with distance, etc., permits one to ascertain the relative lighting powers of the two sources and hence to express the value of one in terms of the other. Where the lights obtained from the two sources are of the same quality—spectral composition—and differ merely in quantity the relative powers of the sources can be determined with a high degree of accuracy by means of the well-known photometric methods. However, when one source supplies, for example, red light and the other green light the eye is unable to determine with any satisfactory degree of accuracy when equality exists.

Many different theories have been advanced as to the reason for the inability of the eye to assign proper relative values to lights that are not identical in color composition—

the cause being physiological rather than physical—but there is no doubt as to the fact itself. Moreover, quite apart from the theories that exist as to the three sets of color-sensitive organs associated with the eye, and the two sets—rods and cones—of light-sensitive apparatus, it is known that there is an apparent shift in the color composition of light with change in intensity. According to this phenomenon, known as the Purkinje effect, the luminosity curve shifts from the red toward the violet in the spectrum as the illumination is decreased. In the present issue Dr. Louis Bell calls attention to an additional apparent change in the color composition of a light when compared with light differing in color. The experiments reported indicate that two contrasting colors viewed simultaneously appear to be separated spectrally to a greater extent than is actually the case. For example, when red and green are compared the former apparently becomes redder and the latter greener. Such an apparent change in color composition or intensity of light would affect detrimentally any measurements made on equality-of-brightness photometers, but should have little effect on flicker-photometer observations. In this respect, at least, the flicker photometer is the preferable one for use where lights differing in color are to be compared. However, the major difficulty involved in using the eye as the real instrument in comparing the strength of two lights of different color still remains as a problem more and more demanding a satisfactory solution for photometricians, by physicists and physiologists.

WIRELESS TELEGRAPHY ON THE ATLANTIC COAST OF THE UNITED STATES.

The article by Mr. James L. Charlton appearing on page 196 of this number gives a comprehensive outline of the wireless-telegraph development on our Atlantic coast line. It is shown that rather more than half of the coast stations belong to the government and are operated primarily for military purposes. The remainder are operated primarily for commercial purposes. Nevertheless, it must not be forgotten that the government stations exert a most important influence in support of mercantile interests, not only by remaining constantly on the watch for alarm calls in cases of disaster at sea, but also in sending out noon signals and storm warnings to all vessels within signal-receiving range. The requirements of a military or naval wireless station are not the same as those of a commercial wireless station. The commercial stations seek to conform as nearly as possible to a standard, so that there may be the maximum degree of security and the minimum amount of delay in the handling of their traffic. On the other hand, the naval stations have to cover the maximum possible range and to control with ease and certainty a wide range in frequencies, so as to be able to change the frequency promptly, either for communicating secretly to a friend or for intercepting the signals of a foe. In time of war the advantage possessed by the navy that has the best drilled and equipped wireless-communication system is likely to be enormous. The effort to keep in the van of wireless progress seems destined to produce more rapid and sweeping changes in naval-station equipments than in the mercantile-station equipments. It seems quite likely that apparatus already in existence for carrying wireless messages out of reach of interference or interception will introduce great changes in naval station equipments. The staff actually engaged in wireless work and accustomed to the well-tried apparatus naturally looks askance upon innovations that destroy existing standardization, but the headquarters staff finds itself reluctantly compelled to introduce improved methods as time and other competing countries punctuate the sentences of wireless development.

The statement in the article to the effect that the intensity of the long-distance signals received on receding vessels is considerable at a distance of about 300 miles, and then falls off rapidly, would have great importance if it were definitely reproducible under all meteorological conditions. Day and night conditions differ so markedly in regard to intensity of received signals that exact measurements lose part of their significance. Moreover, the differences in daylight intensity at different times of the same day or on different days are very large, and this is even more noticeable in night-time intensity. Nevertheless, the statement suggests the influence of reflection of electromagnetic waves from the upper layers of the atmosphere, perhaps 40 or 50 km high. As was first pointed out in our columns, the atmosphere at a certain elevation must possess a tenuity which, in laboratory vacuum tubes, is found to be more highly conducting than salt water. If such a layer is conducting to low electric intensities and the conductivity is developed suddenly at a transition layer, then the sky becomes, electrically speaking, an inverted ocean, which would prevent the dissipation of wireless wave energy in three dimensions, or inversely as the square of the distance, and would, except for losses at the ocean surfaces, confine the dissipation to losses in two dimensions, or inversely as the distance. If, however, the layer of electric conductivity is disturbed so that the conductivity is diffused over a large range of elevation, instead of being confined to a sudden transition surface, then not only will there be no reflection from the upper layers, but the regular three-dimensional dissipation will be exaggerated. Long-distance wireless telegraphy seems destined to accumulate a considerable amount of information concerning the upper layers of the atmosphere in regard to their disturbances by winds or solar ionization.

Until recently it was possible for a business man to escape completely from the toils of his affairs by taking an ocean voyage, and for the purposes of such recuperation a ship became an emblem of refuge. To-day, however, thanks to the influence of wireless telegraphy, the Atlantic ocean routes are but extensions of city streets over the water, so far as relates to isolation and repose of the business soul. The business man's ocean-steamer life is becoming engrossed in ascertaining how his messages with the shore may be received or dispatched. It seems to be only a question of time when all the regular ocean passenger routes will be equally patrolled, and when the great oceans will virtually be reduced to canals so far as relates to communications. Of course, the advantages gained by the new order far exceed the advantages of the old order, but the change is none the less revolutionary.

PROPOSED REVISION OF TARIFF ON METALS AND MACHINERY.

A bill approved by the Democratic caucus was introduced Jan. 24 in the House of Representatives which revises Schedule C (metals and manufactures thereof) of the Payne tariff act of Aug. 5, 1909. As is noted below, the electrical industry is affected either directly or indirectly by changes in a number of items included in the schedule. In general, duties fixed at 45 per cent in the Payne bill are reduced to 25 per cent and specific rates are changed to ad valorem duties.

The duty on machinery, which classification includes electrical machinery, is reduced from 45 to 25 per cent. In the original Payne bill the duty on electrical machinery was 30 per cent, but later it was raised to the higher figure. In 1911 the imports under this schedule were valued at $6,792,692, and an estimate in a table printed with the bill gives $10,500,000 as the probable value of imports under the lower rate. Metallic-filament lamps come under a general clause changing the duty from 45 to 25 per cent. The duty on steam engines is changed from 29.96 per cent (1911) to 15 per cent.

Some notable changes are made in duties on aluminum. The present duty on aluminum ingots is changed from 7 cents per pound to 25 per cent. The London quotation of Jan. 5 for aluminum ingots was 13.6 cents per pound, on which price the duty at the proposed rate would be 3.4 cents per pound, the reduction thus being more than 50 per cent. On rods and sheets the rate is also made 25 per cent, the rate under the Payne bill being 11 cents per pound. The London quotation on Jan. 5 for sheets was 26 cents per pound, on which price the duty at the proposed rate would be 5½ cents per pound. The bill does not specifically mention aluminum wire, the London quotation for which on Jan. 5 was 22.1 cents. If the rate for rods applied to wire, the reduction in duty would be about 50 per cent. Current New York quotations on aluminum are as follows: Ingots, 20@21 cents; rods and wire, 31 cents; sheets, 33 cents. The duty on bauxite, used in the manufacture of aluminum, is reduced from 25.30 per cent (1911) to 10 per cent.

The duty on telegraph and telephone iron or steel wire is reduced from 40 per cent to 20 per cent. The rate on "wires and cables composed of metal and rubber, or of metal, rubber and other materials," is fixed also at 20 per cent, the present duty being 40 per cent.

Both tungsten and zinc ores are placed on the free list; the former now pay a duty of 10 per cent and the latter a duty (in 1911) of 52.58 per cent. The present duty on lead-bearing ores, which in 1911 averaged 52.77 per cent, is reduced to 25 per cent, and on pig lead the reduction is from 93.59 per cent (1911) to 25 per cent. The reduction for nickel is from 16.8 per cent (1911) to 10 per cent, and for zinc from 28.57 per cent (1911) to 15 per cent. The duty on anti-friction balls, ball bearings and roller bearings is reduced from 45 to 25 per cent. The duty on copper in rolled plates, sheets, rods and pipes is changed from 11.48 per cent (1911) to 5 per cent. Machine tools, which pay a duty of 30 per cent under the Payne bill, are transferred to the free list.

Western Electric Company Purchases Telephone Patents.

During the course of a lawsuit relating to the disposition of the purchase money, it developed that last month the Western Electric Company purchased all of the automatic telephone patents of the Lorrimer-Lundquist Company of Chicago for $650,000. Since the expiration of the fundamental Strowger patent, these patents, which cover various principles and details of automatic telephony, have been regarded as important in the automatic telephone field.

FUTURE OF THE ALLIS-CHALMERS COMPANY.

No part of the industrial or electrical world can be indifferent to the effort now being made to perfect plans for rehabilitation of the Allis-Chalmers Company. As an object lesson also in the working out of a more or less typical example of "consolidation," the history, present position and probable future of the company are not to be ignored.

Allis-Chalmers was among the later manifestations of the era of combination. It was unfortunate in this respect, for, unlike some similar organizations, neither prosperity in general, development in any particular department of its business nor appreciation of its assets has been sufficient to carry the burden of its overcapitalization. Added to these drawbacks has been the decrease in demand for certain types of machinery, notably mining equipment, the supplanting of reciprocating engines, and the competition of larger concerns in the electrical field.

Organically the company has suffered from an excess of manufacturing capacity and a shortage of working capital, with the result that the overhead and fixed charges have been out of proportion to the amount of business going through the plants. Whatever is ultimately done in scaling down the $35,000,000 of issued capital shares of the company, a volume of orders commensurate with its manufacturing capacity and overhead charges is deemed absolutely essential to future success.

A fair estimate of the intrinsic value of the Allis-Chalmers properties in 1902 was $14,450,000. There has been issued only $16,050,000 of preferred stock, which is supposed to represent property value, so that it is evident that the overcapitalization up to this point was relatively very moderate. Incident, however, to the acquisition of the Bullock Electric Manufacturing Company in 1905, and to provide more working capital, $15,000,000 of 5 per cent bonds were authorized, and $13,573,000 of these bonds have been issued.

At the present time it is estimated that the lowest reasonable valuation of the company's properties is equal to about three times the market value of the outstanding bonds, which are selling around 55. In addition to these bonds, which with the preferred stock constitute a liability of about $30,000,000, there is outstanding $19,820,000 of common stock.

This leads to a consideration of the company's position as a going concern, and it becomes necessary to consider the intangible, as well as the tangible, assets of the company. In the former classification are included its designs, patents and patterns and its world-wide trade relations and organization, including a skilled staff of engineers and employees. In the same classification is also included trade prestige in a number of lines. When taken over by the Allis-Chalmers combination there was no better known or more widely used line of mining machinery than that manufactured by Fraser & Chalmers. The Gates Iron Works held a like position in the crusher industry. Similarly the Edward P. Allis Company was known throughout the world for its Corliss types of steam engines and its flour-mill and sawmill installations, a prestige that has been retained in a large degree. Conspicuous developments by the company in later years have included municipal pumping plants, the steam turbine, gas engine, long lines of electrical machinery and the application of electric power to mines, mills and shop drives of every description. With respect to hydroelectric plants, and in a lesser degree to several other types of power installations, it is claimed that the Allis-Chalmers Company alone enjoys the advantage of being able to offer under one contract complete units of its own design. These factors, it is held, are to be considered in forming a conclusion as to the future possibilities of the company. It is obvious, however, that the present position of the company shows that the dollars-and-cents value of the prestige or "good-will" of the constituent com-

panies was overestimated, and that the later developments have not proved profitable under existing business conditions.

It is, nevertheless, believed by those who are in closest touch with the company's affairs and presumably the best judges of its possibilities that under improved general conditions and proper management it would be practicable to place the company on a substantial profit-earning basis in two or three years, or in less time should there be a sufficient revival of business to enable the company to operate to full capacity.

First among the necessary steps toward this end is the securing of additional working capital in permanent form and not as temporary loans. This accomplished, it has been suggested that as a means of economy and efficiency all manufacturing operations be centered as soon as possible at the West Allis, the Cincinnati and possibly the Chicago Works No. 2, and that the abandoned plants be sold. That the company devote more of its energies to standard manufacturing lines, adopt a more effective and less expensive sales system, continue the curtailment of administrative and general expense and appoint an active executive committee of Western members of the board of directors are also recommendations now under consideration.

In view of the suggested centralization of the company's manufacturing operations, a word in regard to the three preferred plants is in order. The West Allis establishment has 1,610,113 sq. ft. of floor space. It is of modern construction and well located geographically, bordering as it does on a developing Western country and having both rail and lake transportation. The principal lines of manufacture at West Allis are steam, gas, blowing and pumping engines, steam and hydraulic turbines, large electrical apparatus for complete units of prime movers, switchboards, condensers, air compressors and air brakes.

At Cincinnati, besides the Bullock factory, the company has a plant of 414,814 sq. ft. of floor space. The Bullock plant is also of large capacity and well situated for building up a satisfactory business in smaller electrical apparatus, of which a specialty is now being made.

The Chicago Works No. 2, with nearly 400,000 sq. ft. of floor space, is not so strictly modern as the others mentioned, but is of sufficient capacity for and well adapted to the building of mining and timber-preserving machinery.

With anything like a full utilization of the capacity of the West Allis plant, the company could, in connection with the Cincinnati and Chicago establishments, handle a larger output upon a very economical basis.

Upon some such foundation as this, with increased working capital and a broad constructive yet conservative policy controlling the company's affairs, there is, it is believed, a good prospect of a satisfactory return on a fair valuation of the company's assets.

THE TELEPHONE AND THE SHERMAN LAW.

In a petition forwarded to Attorney-General George W. Wickersham, Mr. George Lambert, Pelham, N. Y., claims that a telephone trust now exists in violation of the Sherman anti-trust law. He states that the American Telephone & Telegraph Company, which controls the Western Union Telegraph Company and eight subsidiary telephone companies in various parts of the United States and is one of the largest financial concerns in the world, having capital approximating $1,000,000,000, now dominates the telephone business of the country. He claims that the methods employed by the company to monopolize the telephone business are replete with manipulations for the obvious purpose of obtaining dominion and control of the telephone business of the country. According to the report people using the telephone service in cities where the telephone trust has exclusive franchises are obliged to pay exorbitant rates, thus rendering it possible for the trust to apply the excessive profit earned in that class of cities to carrying on warfare against independent concerns in other parts of the country. The petition concludes by asking that the Department of Justice institute such proceedings as may be deemed proper to effect a dissolution of the company under the Sherman law.

Mr. Theodore N. Vail, president of the company, in commenting on the petition, stated that any act of the company in the matter of acquiring other concerns was done either after a direct appeal by that company or with the acquiescence of that concern. Every act was passed upon favorably by the authorities in the states interested.

Engineering Congress for San Francisco.

The movement having for its object the holding of an engineering congress at San Francisco during the Panama-Pacific International Exposition in 1915 has assumed definite shape and a committee has been appointed to arrange the details. At a meeting in San Francisco on Jan. 25, attended by twenty-seven representatives of nine national societies, a committee on permanent organization of the body to be known as the International Engineering Congress was chosen, with Prof. W. F. Durand, of Leland Stanford University, as chairman and Mr. Otto von Geldern as secretary. The other members of the committee are Mr. H. A. Lardner, Mr. F. W. Bradley, Mr. George W. Dinkie, Prof. C. D. Marx, Prof. C. B. Wing and Prof. S. B. Christy.

Gas and Electric Schedules in New York.

A meeting was held in Albany, N. Y., on Jan. 17 to consider the tentative report of the committee on gas and electric schedules of the Second Public Service District. The meeting was attended by only about a half dozen officials of properties in addition to the members of the committee. As formal notice, however, had been sent to all of the companies in the State and everybody concerned had been given an opportunity either to send written suggestions or to attend the meeting and submit criticisms of the report, it was felt that it would be proper to pass a resolution in regard to the tentative report of the committee. The following resolution was therefore adopted unanimously:

"Resolved, that the meeting express its general approval of the report as submitted, leaving to the committee the matter of correction of typographical errors and the making of such slight changes in the wording of the report as have been occasioned by suggestions received, and that after these corrections and changes have been made the report be submitted to the Public Service Commission of the Second District."

A. I. E. E. Panama Trip.

The Institute delegation to Panama from New York sailed at noon on Jan. 17, on the steamer *Almirante*, the party consisting of fifty-nine members and guests. The New Orleans party, comprising thirty-eight members and their guests, sailed on the steamer *Cartago* on Jan. 20, at 4 p. m. Ideal weather favored both parties at the start.

President Dunn appointed Prof. George F. Sever the official head of the delegation in place of Mr. Severn D. Sprong, who resigned on account of his inability to participate in the trip.

Through the courtesy of Col. George W. Goethals,

U.S.A., chairman and chief engineer of the Isthmian Canal Commission, a complete program has been arranged for the entertainment of the party while at the Isthmus, including daily inspection trips to different parts of the canal, a reception by the Tivoli Club at the Hotel Tivoli and other courtesies. There are fifteen members of the Institute located on the Isthmus, who will meet the delegation on arrival and assist in making the visit profitable and enjoyable.

The New Orleans party is due to arrive on the return trip on Feb. 6, at 6 a. m., the New York party returning on Feb. 8 at 2 p. m.

CIVIC WORK OF CHICAGO ILLUMINATING ENGINEERS.

The special committee of the Chicago Section of the Illuminating Engineering Society appointed on Dec. 20 to confer with the city authorities on the hanging of the new 10-amp flaming-arc lamps to be used for street lighting in that city reported through Chairman J. R. Cravath at the meeting of Jan. 18. A temporary installation of about 100 lamps is in position under service test in the downtown "Loop" district, and the lamps, which are unusually powerful, have been hung so low that they are not only dazzling to the eyes, but less efficient as light-giving sources. The committee prepared curves showing that with lamps of this type spaced 200 ft. apart the illumination is decidedly better where the lamps are suspended at a height of 30 ft. than in the case of the 20-ft. or less suspension of the temporary equipment. In addition the higher lamps are not so hard on the eyes. The facts were submitted to Mayor Harrison, who referred the committee to City Electrician Carroll. Mr. Carroll did not attempt to dispute the reasoning of the committee, but said that the installation was temporary in character and that the methods of suspension were not permanent. He promised to try the 30-ft. suspension, but pointed out that there was a practical difficulty to be met in trimming lamps placed at this height, as his experience with cut-outs in lowering lamps from high poles had been unsatisfactory. The matter is still under advisement. After listening to Mr. Cravath's report the section indorsed the work of its committee, which is to be continued. The original committee consisted of Mr. Cravath, Mr. T. H. Aldrich and Prof. William E. Barrows. At the meeting of Jan. 18 Messrs. George C. Keech, A. D. Curtis and R. F. Schuchardt were added to the committee, which was instructed to take into consideration also the bad effects of low-hanging commercial outdoor arc lamps.

CANADA'S CONSERVATION COMMISSION.

During the two years of its existence the Commission of Conservation of the Dominion of Canada has made progress tending toward the conservation of the natural resources of the country. The greater part of the work of the Commission on Water and Water-Powers is embodied in a report prepared by Messrs. L. G. Dennis and A. V. White. Their work recounts the general economic conditions regarding water resources, giving comprehensive and detailed information respecting the water-powers of each province. The data include the head of the fall, the amount of power now developed, the amount possible of development and the purposes for which the power is used, wherever this information is available, for each known water-power in Canada. In addition a summary of the laws of each province and of the Dominion governing the disposition of water-powers is included. The commission has reported on various projects for the development of water-powers that have come up before Parliament, and on grounds of public policy has opposed many applications successfully, notably that of American capitalists to dam the St. Lawrence at Long Sault Rapids, the St. Lawrence Power Transmission Company's project and the application of the Minnesota & Ontario Power Company to import energy from Fort Frances, Ont. In all cases of this character the commission has endeavored to follow the policy it has laid down for itself in this regard. This policy may be briefly summarized as follows: That no unconditional titles shall be given to water-powers in Canada and that every grant or lease of powers shall be subject to the following, among other, conditions: (1) Development within a specified time; (2) public control of rates; (3) a rental with the power to revise same at later periods.

PEORIA ELECTRICAL SHOW.

The first electrical show of Peoria, Ill., was opened on Jan. 22, to last a week. It was held in the city's Coliseum and was an event of considerable local importance, the opening being preceded by a street parade and Mayor Woodruff of Peoria making the opening speech. The show was not as large as some, but it fulfilled its purpose well as a bright and attractive educational exhibit. A small admission fee was charged. The larger electrical manufacturing concerns did not exhibit, but there was a wide variety of lamps, fixtures, heating and cooking appliances and other domestic apparatus. A central feature was a column wound with bare wire, and to the person making the best guess on the weight of the wire in pounds a prize was awarded. There was also an exhibit of amateur electrical apparatus made by schoolboys, with prizes for the best. Adams Street, near the Coliseum, was made distinctive at night by special electric-light decorations.

The exhibition of greatest technical interest was that of the National Bureau of Standards, of Washington, D. C., which also made displays at the recent New York and Los Angeles electrical shows. This exhibit was on educational lines. There were copies of the fundamental electrical standards, as the mercury ohm, the Weston normal cell and the silver voltameter, and secondary resistance standards of various denominations, as well as standards of inductance and capacity and photometric standards. Apparatus was shown for the precise comparison of resistance standards by the Kelvin double-bridge method. There was a working demonstration to show the train of operations from fundamental standards through secondaries to the calibration of ammeters, voltmeters, wattmeters and watt-hour meters. The potentiometer method is used, employing a new type of Brooks deflection potentiometer. An interesting frequency meter was shown and also a large collection of photographs of buildings and apparatus as well as the numerous publications of the bureau. In one small frame were vacuum tubes containing five rare elementary gases occurring in the atmosphere in very small quantities, as argon, neon, helium, etc. Each of these gave its characteristic spectrum when excited by a small current of electricity at about 6000 volts. Experiments of this nature, which are very interesting, are made in the effort to obtain a monochromatic light to be used in measuring the wave-length of light to the end of calculating the length of the standard meter with greater exactness. The exhibit also contained magnetic-test specimens and specimens showing the electrolytic corrosion of steel embedded in concrete. Dr. Frank A. Wolff, assistant physicist of the National Bureau of Standards, was in charge of this scientific collection.

Perhaps the most conspicuous exhibit was that of the Peoria Gas & Electric Company, which was centrally located and handsomely decorated. Here were shown heating and cooking apparatus made by the Westinghouse, General Electric and American companies, Holophane glassware, Dietz electric washing machines, Hughes and other electric

ranges, 1912 model fans and many other appliances. A central and popular feature was a Simplex electric oven with glass sides, wherein marshmallows were toasted on crackers and handed out to visitors by young lady attendants.

Among other exhibitors, direct or through others, were the Clinton Sign Company, Clinton, Ia.; C. E. Stapp Electric Company, Peoria; International Correspondence Schools, Scranton; Judd Laundry Machine Company, Chicago; Copeman Electric Stove Company, Flint, Mich.; Illinois Electric Company, Peoria; Robbins & Myers Company, Springfield, Ohio; Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.; Interstate Independent Telephone & Telegraph Company, Peoria; Palmer Electric Company, Peoria; Fostoria Incandescent Lamp Company, Fostoria, Ohio; Pelouze Electric Heater Company, Chicago; Mills Electric Company, Peoria; Thordarson Electric Company, Chicago; Chicago Fuse Manufacturing Company, Chicago; Chicago Electric Vibrator Company, Chicago; M. Klein & Sons, Chicago; W. Douglas Woolley, St. Louis; Richmond Sales Company, New York; C. H. Macdonald Company, Peoria; Hurley Machine Company, Chicago; Anderson Electric Car Company, Detroit; Joseph Barnett & Company, Riverside, Ia.; Electric Storage Battery Company, Philadelphia, and Peoria Electric Fixture Company, Peoria.

During the show Prof. Morgan Brooks, of the University of Illinois, delivered popular lectures on illumination. The annual convention of the Illinois Independent Telephone Association was held in conjunction with the show on Jan. 24. Mr. Leroy A. Mills was the general manager of the Peoria Electrical Show.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS' AFFAIRS.

At the monthly meeting on Jan. 12 of the American Institute of Electrical Engineers eighty-six associates were elected, one associate transferred to full membership and seventy students enrolled. A by-law was adopted extending student membership to post-graduate students in electrical engineering. As announced last week in these columns, the Edison gold medal was awarded to Mr. George Westinghouse, and Mr. F. L. Hutchinson was appointed secretary of the Institute in succession to Mr. Ralph W. Pope, now honorary secretary. The appointment was announced of a committee on electrophysics with the following membership: Messrs. E. B. Rosa, chairman; E. P. Hyde, M. MacLaren, E. L. Nichols, Harold Pender, M. I. Pupin, H. J. Ryan, S. Sheldon, C. P. Steinmetz, J. B. Whitehead, F. A. Wolff, Jr.

MEETINGS AND SECTIONS

A by-law was adopted setting forth that the principal work of a section shall be the holding of regular meetings for the presentation and discussion of papers on matters relating to electricity and to the allied arts and sciences, but that no action which may purport to represent the policy or organization of the Institute, or of any section, shall be published or communicated to any party or parties who are not members of the Institute without the approval of the board of directors.

On the recommendation of the sections committee, authority was granted, in response to the petition of members in Indianapolis and nearby towns of Indiana, to establish an Indianapolis-Lafayette section.

The programs for the special high-tension meeting in New York on March 8 and the special railway meeting on April 5 were reported to contain so much in the way of important papers and discussions that afternoon in addition to evening sessions were authorized.

Upon request of the Schenectady Section, a general Institute meeting to be held at Schenectady early in May on a date to be determined later by the meetings and papers committee was authorized.

NEW GRADE OF MEMBERSHIP.

The amendments to the constitution previously adopted at the December directors' meeting were, after receiving certain modifications, finally adopted by the unanimous vote of the board for submission in due course to the vote of the membership. Great interest is attached to these amendments among technical societies and learned bodies not only in this country but abroad.

The Institute has long been in a somewhat anomalous position in having only 10 per cent of its membership in the grade of full member, while 90 per cent of its membership, although consisting very largely of professional electrical engineers, have been in the grade of associate. For four successive years an attempt has been made to correct this condition by establishing an additional grade of membership for that part of the present associate membership that is professional and technical and equipped with a certain degree of experience, leaving for the grade of associate that part of the membership which is not equipped with this experience and for which the present qualifications prescribed in the constitution are, to quote from the constitution, "a person not less than twenty-one years of age who is interested in or connected with the study or application of electricity," which qualifications were intended to be broad enough to apply to large numbers of non-professional members and others who, although professional, have only begun their experience. The demand for a reformation of the classification of membership has been constant and growing with the growth of the Institute, and has merely followed the precedent in the other great engineering and technical societies of this country and Great Britain, all of which have already more than two grades.

The successive committees on additional grade of membership appointed during the past four years have carefully studied the question, and the present amendments are the result of their successive labors. So difficult was the question of what name to give the new grade, and so great was the confusion among some of the names proposed, as well as among the corresponding names in other societies, where the terms member, associate, associate member are dependent for their significance upon whether they are written with a capital or a small letter, that the committee decided to follow the precedent of the American Institute of Architects, the American Association for the Advancement of Science and several other important American societies, in addition to the precedent set by a large number of British societies, and to employ the designation "fellow" for the highest grade. This is to be accompanied by the designation "member" for the normal grade and by the designation "associate" for the general grade.

The new grading gives opportunity for increasing the standard of the highest grade, which, under the present system of two grades, has been impossible without doing injustice to many members whose training and professional attainments entitle them to rank in some other grade than that of associate. This increase of standard for the highest grade is made in the requirement of ten years' experience where formerly five years' experience was all that was necessary, and along with the increased length of experience goes an increase of dues and of life membership fees.

The grade of member retains the requirement of five years' experience, but does not insist on the former length of time required for responsible charge of work, provided the member is qualified to take such responsibility. The dues for this grade of membership, to which will be transferred a large portion of the present grade of associate, remain unchanged, as do also the dues for and the qualifications for the grade of associate.

No distinction is made between associates, members and fellows in the right to vote, each casting one ballot as formerly.

The board of directors instructed the president over its name to send to all the members a letter explanatory of the details of the new arrangement.

The board confirmed its action of a month ago in unanimously adopting another amendment to the constitution providing for the appointment of the secretary by the board instead of his election by the membership, which amendment will be presented to the membership for its consideration at the same time as the amendment above referred to providing for an additional grade of membership.

HONORARY MEMBERS.

In accordance with the provision of the constitution by which honorary members may be chosen from among those who have rendered acknowledged eminent service to electrical engineering or its allied sciences, provided they are proposed by ten members and elected by the unanimous vote in writing of all the members of the board of directors, Prof. André Blondel, of Paris, France; Mr. C. E. L. Brown, of Baden, Switzerland; Prof. Dr. Emil Budde, of Berlin, Germany; Mr. Sebastian Ziani de Ferranti, of London, England, and Prof. Antonio Pacinotti, of Pisa, Italy, were elected honorary members. These are the first names to receive the distinction of honorary membership since 1892. They were proposed by Messrs. L. A. Ferguson, A. E. Kennelly, John W. Lieb, Jr., C. O. Mailloux, Samuel Sheldon, Henry G. Stott, Elihu Thomson, W. D. Weaver, Schuyler Skaats Wheeler and James Gilbert White.

SAN FRANCISCO INTERNATIONAL ELECTRICAL CONGRESS.

The president was authorized to appoint, with the approval of Chairman Charters, of the San Francisco Section, Messrs. H. A. Lardner, chairman; S. J. Lisberger and George R. Murphy a special conference committee to attend the conference of representatives of the national engineering societies and local societies at San Francisco on Jan. 15 called to take steps to organize a general engineering congress to be held during the early part of the summer of 1915. Instructions were given to the committee that while the Institute, on account of the terms under which it was authorized by the International Electrotechnical Commission and the International Electrical Congress of Turin to hold an international electrical congress at San Francisco in September, 1915, was not able to consider the combining of the general engineering congress with the electrical congress, it desired to participate in the general engineering congress as it had done in St. Louis in 1904, and to support in every way the interests of the exposition and of the Pacific Coast members.

MEETING OF EMPIRE STATE ASSOCIATION.

A meeting of the Empire State Gas & Electric Association was held at the Iroquois Hotel, Buffalo, N. Y., on Jan. 24 to consider the subjects of joint use of poles and railroad crossings. The following resolution was passed by the executive committee of the association on Jan. 16:

"Resolved, that the executive committee commend to the favorable consideration of the member companies the specifications for overhead-line construction contained in the report of the committee on overhead-line construction of the National Electric Light Association submitted at the convention of that association in June, 1911. These specifications set out with great clearness and particularity a high standard of practice which, in the opinion of the executive committee, should be regarded as a standard toward which the companies should strive. Local conditions or special considerations may, however, in particular cases make the adoption of the recommendations of the report, in whole or in part, impracticable or inadvisable, and noncompliance therewith in such cases would not necessarily be bad practice. Upon the whole, however, we consider the report as embodying the best standard of overhead-line construction which has been suggested and recommend its indorsement with the qualifications hereinbefore set forth. We further recommend that the matter of the form of agreement for the joint occupancy of poles be referred to the executive committee with instructions to submit one or more forms for adoption at a later meeting."

The committee on arrangements for this meeting consisted of Messrs. H. W. Peck, chairman; M. G. Kennedy and G. T. Macbeth.

Ohio Electric Light Association Convention.

The eighteenth annual convention of the Ohio Electric Light Association will be held at the Breakers Hotel, Cedar Point, Ohio, on July 16-19. The following papers will be presented: *Purification of Sewage by Electricity,* by Prof. F. C. Caldwell, Columbus; *The Supply of Electric Energy to Rural Districts,* by Mr. O. H. Hutchings, Dayton; *Residential Business,* by Mr. Julius Theobold, East Liverpool; *The Public Utility and Its Relation to the Public, and the Public's Relation to It,* by Mr. D. L. Gaskell, Greenville; *Joint-Pole Line Construction,* by some officer of the Toledo Railway & Light Company. There will be reports of committees on electric transmission, meters, insurance and costs. One of the prominent features of the gathering will be an exhibit, for which no charge will be made to members of the association or to firms that advertise in the souvenir program. It is expected that the attendance will reach 500.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS.

At the opening session of the annual meeting of the Western Association of Electrical Inspectors, held at Milwaukee on Jan. 23, 24 and 25, there was an attendance of seventy-five electrical men and inspectors. The address of welcome to the city, which was delivered by Mayor Emil Seidel, was responded to by Mr. James Bennett, Montreal, second vice-president of the association. In his presidential address Mr. V. H. Tousley, Chicago, directed attention to the increasing influence and usefulness of the body.

The report of the secretary, Mr. W. S. Boyd, Chicago, showed the association to be in a flourishing condition.

The report of the committee on underground systems, which was presented by Chairman H. T. Wreaks, New York, contained specifications relating to subway constructions and pointed out the limiting safe stresses when pulling in cable.

"The Protection of Buildings Against Lightning" was the subject of a paper by Mr. H. B. Long, Nashville, Tenn., in which was cited the large annual loss of life and property from lightning. Descriptions were given of various protective methods. The paper was discussed by Messrs. Dana Pierce, Chicago; W. J. Canada, Denver; Waldemar Michaelson, Omaha, and Emil Anderson, Minneapolis.

New wire specifications, date of enforcement, disposal of old stock, etc., were discussed by Messrs. H. T. Wreaks, James Bennett, W. J. Canada, W. Michaelson, E. Anderson, F. G. Dustin, Minneapolis, and R. J. Swain, St. Boniface, Canada. The association approved a motion urging district inspectors who have not already so ruled to require the new-specification wire in sizes up to and including No. 1 after April 15 and in all sizes after July 1, 1912. Methods of improving the work of inspection were discussed in

detail by Messrs. W. S. Boyd, James Bennett, F. B. Daniel, V. R. Tousley, H. T. Wreaks, B. W. Clark, Detroit; J. H. Fenton, St. Louis, and L. M. Taylor, Dallas.

On the evening of Jan. 23 a banquet was served at the Republican House, with Mr. W. S. Boyd as toastmaster. Responses were made by Messrs. W. Michaelson, F. G. Dustin, L. B. Long, J. Bennett, W. J. Canada, J. S. Mahan, R. J. Swain, L. A. Bailey, G. A. Saylor, H. T. Wreaks, August Rebhan, J. Fenton, Loyal Durand and Fred. Steel.

In a paper on the grounding of secondary circuits Mr. W. J. Canada outlined the history of the development of electric distributing circuits and methods for protecting them against abnormal conditions. The grounding of secondary circuits, which was early recognized by engineers as a possible method of minimizing life and fire hazards, was later permitted by the Underwriters, and probably will some day be required by the National Electrical Code. Experience shows that a normal ground is no more hazardous to life or property than a supposed ungrounded condition. In fact, many operating companies recognize the ungrounded secondary as a fire and life hazard which does not exist with grounded secondaries. The author remarked that the National Electric Light Association is just now a stumbling block to the early settlement of the grounding question by requiring that secondaries operating at emfs above 150 volts be kept free from ground, but those below 150 volts must be grounded, and claimed that the assumption that at an emf somewhere between 110 volts and 220 volts a circuit becomes dangerous to life is evidently fallacious. The hazard increases with the voltage, and the reliance on an absence of ground connection on a circuit creates a false sense of security.

Mr. Canada claimed, in concluding the presentation of his paper, that properly grounded secondaries form a thorough safeguard against the entrance of high voltages from every source on the wiring in a building, prevent personal injury, fires and meter troubles and minimize lamp burnouts and transformer break-downs. Grounding introduces no known troubles not already existing either in life hazard, fire hazard, prejudice to building piping systems or operating difficulties, and increases none. It is effective in proportion to its thoroughness. Thorough grounding entails numerous good easily inspected ground connections placed close to the buildings to be protected. Grounding is equally desirable as a protection against undesigned voltages on all secondary circuits irrespective of the voltage, and should not be prohibited by the National Electrical Code rule because of the very slight current that may be produced through ground connections.

THE STORAGE-BATTERY CAR.

At the regular meeting of the Electric Vehicle Association of America held in New York Jan. 23 Mr. H. E. Pratt, of the Gould Storage Battery Company, New York, presented a paper on "The Storage-Battery Car." After giving a brief history of the early storage-battery cars, the author described the equipment of the Third Avenue Railroad Company, of New York, upon which his paper was based. At the present time this company has a total of sixty-five storage-battery cars in operation on its 110th Street and Twenty-eighth and Twenty-ninth Streets cross-town lines and on the Avenue B division. Up to Jan. 15, 1912, the average mileage made by the original thirty-two cars installed in September and October, 1910, was approximately 20,000 miles per car.

The cars operated by the Third Avenue Railroad Company are of the single-truck type. The length over all is 26 ft. 1½ in., the width of the body is 7 ft. 6 in. and the height over all is 10 ft. 4½ in. The seating capacity of the car is twenty-eight, and it weighs, without passengers but fully equipped, 7 tons. Two General Electric series motors rated at 30 amp and 110 volts are used on each car. The controllers are of the series-parallel type, arranged for operation from either end. Double ball or roller bearings are used on the wheels, and the motors are equipped with ball bearings. The cars are lighted by tungsten lamps, and the batteries are placed under the car seats in a specially ventilated compartment.

While the battery in the original car consisted of forty-four cells of 29-plate Gould high-capacity type with an amp-hour capacity of 420, the number of cells in the later cars was increased to fifty-eight. Under regular operating conditions the average speed of the car is 7 miles an hour, and the maximum speed on a level track is 15 miles an hour. Runs of from 92 to 105 miles are of daily occurrence. The energy consumption of the cars is remarkably low, varying from 60 to 70 watt-hours per ton-mile. This figure, of course, depends to some extent upon the care and skill of the motorman in handling the controller and brakes, and the company has installed amp-hour meters in all of the cars in order that a record of the performance of each motorman and car may be had.

The energy for charging the batteries is obtained from the Kingsbridge generating station over high-tension lines and transformed at the car barns. Including the loss in transmission, transforming and battery efficiency, the actual energy consumed averages between 0.9 kw-hour and 1.1 kw-hours per car-mile. The cost of operating the cars, exclusive of platform expenses, is approximately 7 cents per car-mile, this figure including energy at 1 cent per kw-hour, battery maintenance, oil or grease and repairs to the mechanical and electrical parts. While this cost is considerably lower than that of the cars operated on underground conduit lines, it should be borne in mind that the latter are considerably heavier and also have greater passenger-carrying capacity.

The thin-plate, high-capacity battery developed by the Gould Storage Battery Company, according to the author, has shown outputs as high as 14 watt-hours per pound of plate. It was expected that increased capacity would result from the increased number of plates, but the total number of discharges which could be obtained would be correspondingly reduced. The decreased discharge rate per plate is a factor tending toward an increase of plate life, but this advantage appears to have been offset to some extent by the shedding of active material of usual positive plate compositions. A harder plate composition seemed to present the difficulty of deficient capacity. The mass of the plate is extremely hard originally, and when developed a superficial area only becomes softened, the interior still remaining in the original hard state. The capacity of the plate results almost entirely from this softened outside layer, and, as this wears off in the form of sediment with the continued use of the battery, the surface of the remaining mass of material becomes active. The plate thus retains its capacity as long as any of the hard core is present, and it has exceptional wear-resisting qualities. With a plate of this nature the life can be figured in total amp-hours, instead of the number of charges and amount of overcharge. As is probably well known, the Gould battery is of the Planté type.

The paper was discussed by Messrs. T. F. Mullaney, Walter Quinn, J. M. Gallagher, W. E. Winship, A. B. Lisle, F. W. Smith and R. M. Lloyd.

Mr. Mullaney told of the experience of the Third Avenue Railroad Company with the gasoline-electric car, which operated successfully for seven or eight months on its cross-town lines, but was discarded owing to the high operating and maintenance costs. He said that the company has a contract with the Gould Storage Battery Company to maintain the batteries at so much per car-mile. The company has never yet failed to get over 100 miles on a single charge out of the battery, and from 60 to 70 miles is required for a day's work, so that the company must have a battery

with reserve power for emergencies. On the horse cars six shifts of horses a day are required, so that the comparison between the operating costs is very favorable. Experiments are being made with oil stoves for heating the cars, the stoves being placed under the body of the car. So pleased has the company been with the storage-battery car that it has placed in operation storage-battery snow plows and four storage-battery emergency wagons. During the recent snowstorms in New York the storage-battery car was the only one not giving trouble. One set of batteries, Mr. Mullaney said, has given 21,000 miles so far. Mr. Lloyd, of the General Vehicle Company, told of a storage-battery car which had been shipped to California and will operate on tracks part of the time and on the roads the rest of the time. He also told of the use of storage-battery locomotives in the new water-supply tunnels at present being constructed under New York City.

MEETING OF MAINE ELECTRIC ASSOCIATION.

The regular quarterly meeting of the Maine Electric Association was held at Armory Hall, Bath, Me., on Jan. 18, with President Plummer in the chair. About eighty persons were in attendance. Papers were read by Mr. A. H. Abbott, of the General Electric Company, Boston, on "The Ozonator," and by Mr. H. W. Eells, superintendent of the Portland Electric Company, on "New-Business Getting." Mr. Eells reviewed the economic importance of carrying heavy loads upon central-station systems and voiced the need of a continuous new-business campaign. He criticised the policy of locating the company office in an obscure part of the city and said that it should be practically as accessible as the corner drug store, properly fitted up, and not situated in some inferior building cast off by all the progressive elements in the community. The convenience of the telephone cannot offset the value of a face-to-face interview. Seasonable appliances rather than a varied lot of fixtures and devices should be displayed. If a company cannot afford to carry in stock any of the larger and more expensive apparatus, any prospective customer for whom such apparatus has been purchased would undoubtedly consent to the exhibition of his equipment for a day or so, with a suitable display card. In this way double advertising is accomplished and the interest of competitors aroused. Shop-worn appliances and disorderly appearances in the office should be avoided. The office should not be allowed to become a lounging place for employees when off duty. Mr. Eells said that in carrying forward publicity work in a small town which cannot support a daily paper the period intervening between the issues of a weekly journal is too long to hold the interest of the reader in a closely related series of advertisements or talks. One satisfactory scheme is to carry on a series of advertisements in which the attention of the reader is first attracted by some clever discussion of the benefits of electrical service, followed by a list of recent customers whose requirements are similar. By publishing a list from time to time of the business men who are using electric power the interest of the public in watching the list grow can be aroused. The merchants included appreciate the free advertising, and others are stimulated to become more progressive.

The author estimates that one solicitor can handle from 15,000 to 20,000 inhabitants. In towns of less than 15,000 the manager must personally conduct the work of new-business getting, with the assistance of a meter calibrator or other technical employee to facilitate tests and demonstrations. The value of personal acquaintance is reflected in high net earnings per capita. Lists should be prepared of every possible customer in the territory and every possible appliance which could be used in individual cases. Old customers are prospective new ones for everything they do not already use. The benefits of selling electric motors on the instalment plan are great. Mr. Eells contended that special efforts should be made to secure day loads in business houses using light on or near the regular peak. He also discussed residence business, pointing out the opportunities of gaining household day loads in connection with cooking, heating and small motors. Appliances can be installed in residences with little or no additional wiring cost in most cases. Special appliance circuits may sometimes be run free carrying the service to the cellar and placing baseboard outlets in the rooms on the ground floor. A beginning in house lighting may be made in the cellar. The aim should be to load the station for every kilowatt-hour it will stand.

WISCONSIN ELECTRICAL ASSOCIATION CONVENTION.

At the Hotel Pfister, Milwaukee, Jan. 18 and 19, was held the fourth annual convention of the Wisconsin Electrical Association, an organization which, as the successor to the old Northwestern association, has met regularly during the last twenty years. Vice-president Irving P. Lord called the opening session to order, and Secretary-Treasurer George Allison, Milwaukee, followed with the minutes and reported the flourishing financial condition of the association, the dues of which are now assessed on the basis of 0.05 per cent of the gross earnings of member companies.

The report of the committee on insurance, comprising Messrs. C. N. Duffy, chairman; A. K. Ellis and Peter Valier, presented some striking facts on the relation which the premiums paid by utility companies bear to the indemnities received. Of $3,500,000 paid in each year by the electric-lighting companies of the country, and $7,500,000 by the electric railways, only 14 per cent is returned in indemnities, 86 per cent going to the insurance concerns for their operating expenses and profits. The insurance companies, it was declared, dictate the rates, rules and forms of contracts, the insured having no voice in the transaction. The committee therefore recommended the building up of a mutual fire-insurance reserve among utilities by setting aside 25, 50 or 100 per cent of the present premiums paid. The employment of an insurance expert to advise the association member was also suggested, and advice was given on methods of decreasing risks and premiums. Not one fire, it was pointed out, occurred during 1911 in buildings fitted with automatic sprinklers.

Mr. W. B. Voth, Sheboygan, followed with a paper on "The Relation of the Central Station to the Wiring and Supply Business," in which he urged leaving to the contractors this special department, establishing in this way the best co-operation between company and contractors. The subject was discussed by Messrs. P. H. Korst, Janesville; J. S. Allen, Lake Geneva; H. C. Sterling, Three Rivers, Mich.; Edward Daniell, Marinette, and I. P. Lord, Waupaca. Mr. Egbert Douglass read a paper on "Commercial Development of Central-Station Business," in which he presented a careful analysis of the methods of locating and securing lighting and motor service. Mr. Douglass had prepared a similar paper for the Milwaukee Section of the N. E. L. A., and abstracts from this were given in these columns Nov. 11 and 18. Messrs. W. H. Winslow, Superior; M. C. Ewing, Wausau, and Edward Daniell, Marinette, discussed the paper.

Delayed in reaching Milwaukee by a belated train and expressing the fervent hope that the railroads of Wisconsin might some day be electrified, the president of the association, Mr. George B. Wheeler, of Eau Claire, reached the convention hall just at the close of Mr. Douglass' paper and delivered his official address. Subjects of co-operation, public policy, courtesy to the public and the enhancement of the popularity of private utilities were among the topics

discussed, and in closing President Wheeler recommended the establishment of an association press bureau that members might benefit from co-operative publicity and advertising matter.

Mr. C. H. Crownhart, chairman of the Industrial Commission of Wisconsin, was present at the afternoon session and outlined the provisions and workings of the new state workmen's compensation law. Employers who elect to come under this act grant their employees 65 per cent wages during periods of disability, 65 per cent for four years in case of total disability and the same amount in case of death. Those employers who neglect to come under the compensation law are denied the defences of the fellow-servant and assumed-risk pleas in case of suit. Mr. P. H. Korst, Janesville, reported the favorable views of a number of Wisconsin utility companies regarding the new law. Many have accepted its terms, believing such adjustment to be simpler, cheaper and more just than opening liability to lawsuits. A few declared they preferred to watch the working of the law before coming under its provisions. The subject was discussed by Messrs. W. H. Winslow, Superior; Ernst Gonzenbach, Sheboygan; R. N. Kimball, Kenosha, and L. J. Block, St. Louis, Mo., the last-named describing an indemnity exchange which is in operation in the Southwest. Its member companies pay 30 per cent of their former insurance premiums to the Utility Service Company, which manages the undertaking, the remaining 70 per cent being set aside as a deposit fund, half of which is later returned and the other half credited to a surplus providing for paid-up insurance.

A review of recent legislation in Wisconsin affecting public utilities was next presented by Mr. A. W. Fairchild, attorney, Milwaukee. In the course of this valuable review it was brought out that the Legislature may take upon itself the passage of an act going over the head of the commission created to deal with individual cases, as was illustrated in the case of the special legislation directed at the Kenosha competitive situation.

An illustrated discussion of the causes and effects of rainfall, stream flow and floods in Wisconsin rivers was given by Prof. D. W. Mead, of Madison, who closed his address with the exhibition of a number of striking photographs of the Black River disaster of October. Professor Mead made a plea for state compilation of adequate stream data and state inspection of plans and construction of hydraulic structures subject to floods.

An illustrated paper describing the Cold Spring car shops of the Milwaukee Electric Railway & Light Company was presented by Mr. R. H. Pinkley, superintendent of buildings for the company. The use of tungsten lamps for lighting these shops was discussed briefly by Messrs. W. B. Voth, Sheboygan, and F. A. Vaughn, Milwaukee.

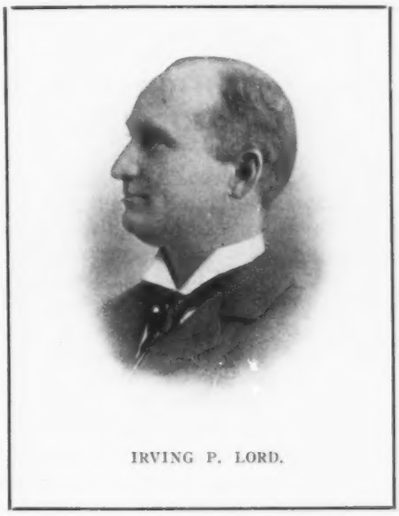
The session of Thursday morning was opened by Mr. F. J. Maxwell, of Fond du Lac, who detailed the work of the chief accountant of a public utility operating in a city of 20,000 population. Mr. Maxwell's paper included the discussion of dealings with customers, forms for billing, notification, discontinuances, etc. Mr. A. E. Peirce, of Eau Claire, told of his successful use of meter-reading return post cards.

The history of the development of electrical illuminants, modern arc-lamp and incandescent-lamp installations for street and interior lighting and illuminating "stunts" were sketched rapidly in an illustrated address by Mr. W. D'A. Ryan, of the General Electric Company, of Schenectady, N. Y. Matters concerning street lighting were discussed briefly by Messrs. W. H. Winslow, Ernst Gonzenbach, A. E. Peirce and Egbert Douglass.

"Recent Developments in Electric-Heating Devices" were described by Mr. J. D. A. Cross, General Electric Company, Chicago, who appended to his address some interesting new figures on the energy consumption of electric cooking, showing that, owing to the saving in meat juices, electric cooking may be much more economical than gas. Mr. Cross also exhibited a moving-picture film depicting the servant problem and its solution by electric devices. This film has been loaned to several Wisconsin central stations to stimulate interest in heating devices.

An unusual compilation of arguments and facts dealing with the operation of public utilities was presented by Mr. C. N. Duffy, comptroller of The Milwaukee Electric Railway & Light Company. The author discussed both railway and lighting utilities, having compiled striking figures based on the operation of the Milwaukee and other public-service companies and considered problems and factors in electric-service rates, methods used to increase business, etc. He closed with an analysis of the fallacies of municipal-plant operation and competition. It is hoped to present later in these columns a more extensive outline of Mr. Duffy's classical study of central-station operation than is possible here.

Mr. M. C. Ewing, general manager, Wausau, followed with a paper entitled "How to Make a Street-Railway Park Pay." Mr. J. L. Davis, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., discussed recent electric-railway developments, describing the improved economies to be obtained by operating multiple-unit trains instead of the usual motor car and trailer. He also pointed out how an improper gear ratio may impair operating efficiency more than a heavy motor equipment, and described the method of motor field speed control with modern interpole railway motors. Such equipment is especially advantageous where there are many stops, since it decreases by 45 per cent the losses during starting. The new Pennsylvania terminal locomotives at New York, which are so equipped, suffered only thirteen minutes' delay in 175,000 train movements during the year's operation.



IRVING P. LORD.

"The Relative Merits of Single-Phase and Multiphase Distribution" were discussed by Mr. C. N. Jewett, of the Wagner Electric Manufacturing Company, St. Louis, Mo. After showing the lower transformer and installation cost with single-phase motor equipment, compared with two-phase or three-phase motors, the speaker demonstrated that, contrary to the common opinion, such single-phase motors create less line disturbance on starting than do the ordinary small polyphase induction motors without starters. In closing Mr. Jewett referred to the new adjustable-speed single-phase motor shortly to be ready for the market and the unity-power-factor motor introduced last year.

The election of officers was held Thursday afternoon, the convention voting unanimously to accept the recommendation of the nominating committee composed of Messrs. Clement C. Smith, Milwaukee; Edward Daniell, Marinette,

and H. A. Miles, Durand. The following officers were then declared elected for 1913: President, Irving B. Lord, Waupaca; vice-presidents, W. H. Winslow, Superior; R. N. Kimball, Kenosha, and William Wallen, Oshkosh; secretary-treasurer, George Allison, Milwaukee.

Mr. Irving P. Lord, the newly elected president of the association, was one of the charter members and a former president of its predecessor, the Northwestern Electrical Association, which was formed in 1893. By profession an attorney, Mr. Lord became associated with Mr. Alex. Dow when, in 1888, the latter, representing the Brush company, established an electric plant at Waupaca, utilizing water-power. Later, with Mr. W. B. Baker, Mr. Lord formed the Waupaca Electric Light & Railway Company. Since 1898 Mr. Lord has been the executive head and principal owner of this company.

The culminating event of the Wisconsin convention of 1912 was the superb banquet served Thursday evening in the Fern Room of the Hotel Pfister. Nearly 200, including many ladies, were present. The room was prettily decorated with flags and flowers, and the menu was excellent. Mr. C. N. Duffy acted as toastmaster. To the genial toastmaster's witty introductions brilliant responses were returned by the Rev. W. I. Dorward, Milwaukee; Mr. George B. Wheeler, Mr. Irving P. Lord, Mr. Levi H. Bancroft, Attorney-General of the State of Wisconsin, and Mr. J. Adam Bede, ex-Congressman, of Duluth, Minn.

LEGISLATION AFFECTING ELECTRICAL COMPANIES IN KENTUCKY.

Senator Herman D. Newcomb, of Kentucky, has introduced in the State Legislature a bill providing for the establishment of a commission to regulate, enfranchise and arbitrate between all public-service corporations. The commission is to be composed of three persons appointed by the Governor from the three railroad districts of the State and approved by the Commonwealth. The bill provides that the commission shall have supervision of all the telephone, telegraph and express companies in Kentucky, and that every such company shall on or before Sept. 1 each year make to the commission a full statement of its affairs as existing on July 1 preceding.

The Newcomb measure provides for the regulation of telephone charges according to a graded scale from $60 per annum or $5 per month for a private line, unlimited service, to $18 per annum or $1.50 per month for a public line, unlimited service. The commission is also to be vested with authority to suggest improvements and conveniences in telephone service for the accommodation of the public, and may institute legal proceedings to enforce compliance with such suggestions.

Representative J. H. Williams, of Greenup County, has introduced a bill providing for the use of electric headlights by every railroad corporation operating locomotives within Kentucky. Each headlight shall be of not less than 1500 cp, and a penalty of not less than $100 or more than $1,000 is prescribed for each separate violation of the law.

EMPLOYERS' LIABILITY LEGISLATION IN CALIFORNIA.

Three bills affecting employers' liability, introduced by Senator L. H. Roseberry, were passed by the Legislature of California at the special session ended recently. The new acts amend the employers' liability measures passed at the last regular session of the Legislature and increase the power of the State Industrial Accident Board.

The State Industrial Accident Board is authorized to gather statistics relating to all industries in the State, except those relating to farming, dairying and horticulture. The refusal of any employer to aid the commission in this work makes him liable to a penalty, while the board, on the other hand, is prohibited from making public any information it obtains. The sum of $15,000, to be taken from the general appropriation of $50,000 allowed the commission, is granted the board to carry out the provisions of the act.

All employers must submit a complete report of any accident to the board within fifteen days. This must cover all particulars relating to employer and to employee, the latter's extent of service at such employment, salary, etc., as well as the date and hour of accident and the cause. Supplemental reports must be filed by the employee, stating the claim and desired settlement by physicians and by insurance companies. A penalty of fine or imprisonment is imposed upon employers who fail to file reports within the time stipulated.

Employers may form inter-insurance associations to exchange indemnity claims of injured employees, with prescribed license fee for such co-operation. Employers, whether individuals, partnerships or corporations, may join with other employers in fund contribution for the assistance of injured employees.

Public Service Commission Agitation in Pennsylvania.

Much interest is felt by officials of public-utility companies in Pennsylvania regarding the public-service commission bill which is under discussion in that State. During the 1911 session of the Legislature of Pennsylvania a bill providing for the appointment of a public-service commission was passed by the House of Representatives. When the bill came before the State Senate it was referred to a commission. The bill is still in the hands of this commission, but it is expected that it will be brought before the Legislature at the session of 1913. It has been reported, however, that a special session of the Legislature might be called to take action regarding a measure on this subject.

The bill which was before the Legislature of 1911 applied to practically all classes of corporations or persons engaged in any branch of public-utility business. It also applied to municipal corporations engaged in the manufacture and supply of gas or electricity, the supply of water or disposal of sewage for public purposes. The provisions of the bill were comprehensive and gave the commission general administrative power and authority.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION.

The Public Service Commission, Second District, will this week give a further hearing upon the application of the Schoharie Light & Power Company, the Catskill Illuminating & Power Company and the Upper Hudson Electric & Railroad Company, for approval of consolidation and authority to issue stock and bonds.

The commission has made an order requiring the Warwick Valley Light & Power Company to improve and repair its distribution system in the village of Warwick, Orange County. Provisions are required for the safe operation of telephones and electric lights when wires of both concerns are on one pole, so that there will be no danger to telephone users by contact from electric-light wires. Electric-light wires are required to clear the surface of the highway or sidewalk by not less than 20 ft. All street fixtures must be supplied with new and adequate reflectors.

The Central Hudson Gas & Electric Company has been authorized by the commission for the Second District to issue additional common capital stock to the aggregate amount of $525,000. The stock is to be sold at not less than 105, or exchanged for bonds. The proceeds of the sale of such stock are to be used for paying off and discharging bonds issued by the former Poughkeepsie Light, Heat & Power Company.

The Nassau Light & Power Company has been authorized to issue its first-mortgage bonds dated Oct. 1, 1907, to the par value of $158,000, the proceeds to be applied for extensions and improvements to the plant and property of the company.

The commission has closed upon its records the complaint of the Meridian Telephone Company, of Meridian, Cayuga County, against the New York Telephone Company for refusing connection with the lines of that company. A satisfactory disposition of the case was made by the New York Telephone Company arranging for a connection with its lines.

Hearings were continued Jan. 24 before Commissioner Maltbie, of the commission for the First District, on the complaint of stationary engineers in New York City that discriminatory rates are given by the New York Edison Company to large users of energy. Examination of the auditor of the Edison company upon the meaning of statements in annual reports of the company was resumed by counsel for the complainants. The witness was questioned upon the earnings of the company, its output, the capacity of its stations, its general operating methods and upon the standard contract and order forms offered to various classes of customers. None of the operating data, forms of procedure or other information concerning the company testified to by the witness differed from those already on public file at the office of the commission. The next hearing is scheduled for Jan. 29.

Application has been made by the Consolidated Gas Company of New York for permission to acquire a controlling interest in the New York & Queens Electric Light & Power Company and the New York & Queens Gas Company.

OHIO COMMISSION.

The Home Telephone Company, of Pike County, Ohio, has made application to the Ohio Public Service Commission for authority to purchase the property of the Grand Union Telephone Company, a Bell corporation operating in the same territory. Supplemental to this was an application for the approval of a contract for the exchange of service between the Home Telephone Company and the Central Union Telephone Company.

An application was also made for the approval of a contract for the exchange of service by the Scott Home Telephone Company, of Haviland.

MARYLAND COMMISSION.

Mr. Philip D. Laird has been advanced to chairman of the Public Service Commission from the position of commissioner, which he occupied from the time of the organization of the body. He will serve four years and succeeds Mr. James N. Ambler, who was named to the Supreme Bench of Baltimore City. Mr. Laird recently attracted public notice by refusing to concur with his colleagues and filing a minority report on the finding of the commission relative to the telephone-rate controversy. Mr. Benjamin T. Fendall was appointed to fill the unexpired term of Mr. Laird as member of the commission. Mr. Fendall was city engineer for twelve years and until last fall. Before that time he was in the engineering department of the Baltimore & Ohio Railroad.

Amendment of the Public Service Commission law and of some provisions of Article 23 of the Code of the Public General Laws is recommended in the report of the commission as presented to the General Assembly. Among the suggestions are the establishment of a rule to govern issue of stock by a corporation in payment of net earnings applied to the improvement of its properties. Where two or more corporations pass under one control, but the separate organizations are preserved for purposes that are not always apparent and may not be desirable from the public standpoint, a real consolidation should be required. Exceptions should be provided in the prohibition of one corporation guaranteeing the bonds of another corporation. Other recommendations are revision of provisions governing bond issues by corporations in proportion to their authorized capital, definition of commission's power to require interchange of service between independent telephone companies, and enabling the commission to establish a scale of fees for the inspection of gas and electric meters. Bills in line with these recommendations may be presented at this session.

A complaint was filed before the Public Service Commission last week by the Baltimore Electric Supply Company questioning the charter right of the Consolidated Gas, Electric Light & Power Company to compete with electrical contractors and supply dealers. The commission is requested to investigate the charter privileges of the Gas & Electric company and to require it to suspend all activity of this character if its articles of incorporation do not allow it this field of operation. There are in Baltimore more than 100 electric supply companies, as well as numerous unattached electricians, whose livelihood is threatened, it is claimed, by the Gas & Electric company's activities. The only relief the complainants can have in the event of the question being beyond the jurisdiction of the Public Service Commission is a petition to the Attorney-General to examine the company's charter and pass upon its right to conduct the side lines of business.

It is reported that the Consolidated Gas, Electric Light & Power Company will propose to the Public Service Commission that the London sliding scale of rates be authorized for use by the company. Under this plan there would be a reduction of 5 cents in the price of gas per 1000 cu. ft. for each additional 1 per cent of common-stock dividends.

The Baltimore County Electric Company last week petitioned the commission for permission to take over the electric property of the Baltimore County Water & Electric Company. The petition states that the property desired to be transferred is worth $371,000 and the purpose is to pay for it with $150,000 of the stock and $221,000 of the first-mortgage 5 per cent bonds of the Electric Company. The Baltimore County Electric Company was chartered at the last session of the Legislature with a capital of $50,000. Albert H. Wehr is at the head of the enterprise. Necessary legal steps to increase the capital stock to $150,000 have been taken.

WISCONSIN COMMISSION.

The Wisconsin commission has authorized the Beloit Water, Gas & Electric Company to issue $900,000 par value of 5 per cent bonds, each bond to be redeemable at any time upon sixty days' notice at 3 per cent above par plus accrued interest. The bonds are to be secured by a trust deed constituting a first lien upon all the property, real and personal, of the corporation and upon all assets of the company. The total issue to be so secured is $3,000,000, of which the above sum is to constitute a part. The trust deed is to contain a provision that none of the $3,000,000 of bonds authorized thereby, except the $900,000 now authorized by the commission, are to be released by the trustees except for improvements or permanent extensions and additions to the plant and property of the corporation, and then only to the amount of 80 per cent of the cost of the new construction and provided that the net earnings of the corporation for the previous twelve months shall equal or exceed twice the interest charges on the amount of bonds then outstanding and those to be issued for the new construction. The trust deed is also to contain a provision that after Jan. 1, 1915, the corporation shall annually pay over to the trustees a sinking fund amounting to 1 per cent of

the principal of bonds outstanding at time of payment, the sum to be used in purchasing bonds secured by the trust deed or for retiring the same. The bonds are not to be sold for less than 87.5 per cent of par value.

The issue now authorized by the commission is to be used to retire $150,000 of first-mortgage 6 per cent bonds of the Beloit Water Works Company, at a price which must not average to exceed 2 per cent above par plus accrued interest; $30,000 of 5.5 per cent bonds of the Beloit Gas Light & Coke Company, at a price not to exceed 5 per cent above par plus accrued interest; $520,000 of 5 per cent bonds of the Beloit Water, Gas & Electric Company, at a price which as to at least $450,000 will not average to exceed 90 per cent of par plus accrued interest and the remainder not to exceed par, to liquidate and pay at par $15,000 of the $415,000 of construction notes now outstanding or renewals thereof, the remainder of the issue to be used for extensions and additions to the property.

The La Crosse Gas & Electric Company has been authorized to issue $1,100,000 par value of bonds, to be dated as the board of directors shall determine, to bear interest at not to exceed 5.5 per cent and to be secured by a mortgage or trust deed upon all property and effects of the company. The bonds are to be issued in exchange for the outstanding bonds of the Wisconsin Light & Power Company, which bonds have been assumed by the petitioner, and in exchange for an outstanding bond issue of the petitioner in the amount of $600,000. For such an amount of the latter issue as may not be exchanged the company receives authority to sell the bonds authorized for cash and retire such bonds as are not exchanged. The balance of the issue is to be issued and sold for money only and the proceeds used for paying the outstanding indebtedness incurred by reason of extension and additions made to the property.

Current News and Notes.

Toledo Rate Contest Ended.—Last week the Toledo (Ohio) Railways & Light Company filed its acceptance of a lighting ordinance which provides for a rate of 8 cents per kw-hour, with a discount of 1 cent on all bills paid by the tenth of each month. A minimum charge of 50 cents per month is allowed. At first the company refused to recognize the ordinance, and the city secured a temporary injunction compelling the acceptance of the rates. Since then payments have been accepted with the understanding that the city was to make up the difference if it should be decided that the company was entitled to rates according to its own figures.

* * *

Alabama Light & Traction Association.—During the convention of the Alabama Light & Traction Association held recently at Mobile, Ala., officers for the ensuing year were elected as follows: President, Mr. C. E. White, Montgomery Light & Water Power Company, Montgomery; vice-president, Mr. C. C. Henderson, Henderson Light & Power Company, Hendersonville; secretary-treasurer, Mr. G. S. Emery, Mobile Electric Company, Mobile. Members of the executive committee were chosen as follows: Messrs. B. H. Clingerman, Mobile; R. L. Ellis, Selma; K. L. Simmons, Birmingham; J. M. Cranford, Jasper, and C. R. Smith, Demopolis.

* * *

The Economic Savings of the Tungsten Lamp.—If every carbon-filament and graphitized-filament lamp in use were to be replaced by tungsten lamps of 1.25-watt specific consumption, what would be the economic saving each year? Mr. Martin P. Rice, of Schenectady, N. Y., in an address before the Byllesby convention on Jan. 5 estimated this annual saving at the enormous sum of $240,000,000, but pointed out, of course, that the result of introducing the tungsten lamp has been to raise the standard of illumination rather than actually to save energy consumption. Although this condition is fortunate for the central-station industry, the tungsten lamp is none the less to be credited with the great saving it has effected as referred to the economics of the country.

* * *

Competing Central Station Restrained from Competition.—The Kentucky Electric Company, of Louisville, Ky., has instituted proceedings against the Louisville Lighting Company bearing upon the right of one electric company to enter an apartment house and furnish individual service to a single tenant therein when the establishment is already wired and supplied by a competitive company. The complainant alleges that it is doing business with tenants in other apartments and that its wires were interfered with, and upon their restoration a threat was made to disconnect them again. The judge has issued a temporary injunction restraining the Louisville company from interfering with competitive service in this instance, and the case will be heard on its merits within the next few weeks.

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Contract Order Routine Committee of N. E. L. A.—Messrs. E. W. Lloyd, R. S. Hale, C. N. Stannard, M. S. Seelman, Jr., T. I. Jones and J. D. Israel, who compose the contract order routine committee of the N. E. L. A., will meet in Chicago on Feb. 5 and 6. This committee is doing an excellent work in investigating the interval of time consumed by many of the larger companies in the country between the signing of a contract for electric service and the turning on of current, with a view to reducing this period to a minimum. A wide range of questions on routine has been sent to the larger companies, and many of these have responded in considerable detail and have furnished the committee with copies of the clerical forms used by them and with other valuable data. This information will be thoroughly sifted by the committee, and a standard form of routine, by means of which many needless steps will be eliminated, will be determined upon by the committee.

* * *

Boston Electrical Luncheons Begun.—Over 300 electrical men were present at the first weekly luncheon under the auspices of the New England Section of the National Electric Light Association, which was held at the American House, Boston, at 12:30 p. m. on Jan. 19. The attendance was record-breaking considering the time of day at which the meeting occurred. Chairman L. D. Gibbs, of the Boston Edison company, called the meeting to order and briefly outlined the purpose of the gathering, which is to facilitate both business and social intercourse between all the members of the electrical fraternity in New England. Many electrical engineers, central-stations and supply men from points outside Boston and Massachusetts were present. It was announced that Friday is to go upon the calendar of electrical New England as "electrical day." The luncheons will begin exactly on time and will be concluded at 2 p. m. sharp. It is planned to have addresses weekly by men of prominence in all branches of electrical service. Arrangements are being made for the sale of both yearly and "commutation" tickets to reduce the amount of clerical work required and establish a fund for current needs. Other speakers at the first luncheon were Messrs. C. B. Burleigh, General Electric Company; E. W. Langley, New England Telephone & Telegraph Company; H. H. Van Staagen, Westinghouse Electric & Manufacturing Company; Carroll Westall, Pettingall-Andrews Company; J. Q. Bennett, president Cambridge Electric Light Company, and H. B. Gilmore, Western Electric Company.

GROUNDING SECONDARIES IN DENVER.—In the article on grounding secondaries in Denver which appeared on page 1380 in the issue of Dec. 2, 1911, an error was made in the reproduction of the diagram showing the method of grounding. The neutral lead of the low-tension circuit should be shown grounded instead of the outer wire.

* * *

PITTSBURGH SECTION, I. E. S.—A movement is under way tending toward the re-establishment of a section of the Illuminating Engineering Society at Pittsburgh. It is thought that at least 150 members can now be obtained for the society in the Pittsburgh neighborhood, and that an active section can be established at that place.

* * *

NEW YORK SECTION, I. E. S.—A meeting of the New York Section of the Illuminating Engineering Society will be held in the Engineering Societies Building on Feb. 8. A paper on "Choice of Reflector: Its Influence on Illuminating Efficiency and Depression of Visual Function," will be presented by Messrs. Arthur J. Sweet and L. C. Doane.

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ST. LOUIS LEAGUE OF ELECTRICAL INTERESTS.—At the luncheon of the St. Louis League of Electrical Interests held at the City Club, St. Louis, Tuesday, Jan. 23, Mr. Guido Pantaleoni, of the Westinghouse Electric & Manufacturing Company, addressed the club on the subject of "The Introduction of Alternating-Current Machinery in America," in which work Mr. Pantaleoni was among the pioneers.

* * *

COLORADO ELECTRIC CLUB.—At the mid-week luncheon of the Colorado Electric Club on Jan. 18 the retiring president, Mr. W. P. Carstarphen, presented the newly elected officers, namely, president, Mr. W. G. Matthews; vice-president, Mr. C. N. Stannard, and secretary, Mr. C. F. Oehlmann. The present membership of the club is 408. The Hon. T. J. O'Donnell gave an interesting talk on the relation of business to politics. He pointed out that politics is not always detrimental to business, and as an instance referred to its influence on the introduction of safety appliances.

* * *

INACCURATE CENTRAL-STATION METERS.—Mr. R. E. Campbell, of the National Electric Lamp Association, Cleveland, Ohio, in an address before the Nela Engineering Society on Jan. 18, on the subject of "Line Voltage Conditions," stated that, in the course of extensive investigations of conditions under which lamps are operating on the circuits of some of the smaller central stations in Ohio, Nebraska and Iowa, he found in the majority of the stations visited that the switchboard voltmeter was in error, the inaccuracy ranging from 1 volt to 10 volts, with an average of about 4 volts.

* * *

STREET ILLUMINATION IN BALTIMORE.—Plans will soon be prepared for elaborate street lighting in Baltimore in view of the coming meeting there of the Democratic National Convention. There was a conference on the subject, at which were present Mayor Preston, members of the Municipal Architectural Commission, City Engineer McCay and Mr. George A. Miller, of New York City, who has recently designed street-lighting systems for Atlanta and Minneapolis. Special committees were appointed to cooperate with Mr. Miller in elaborating street-lighting plans, including one for a "Great White Way."

* * *

EMPLOYEES' INVESTMENT COMPANY.—The Nela-Alpha Investment Company has been organized at Cleveland, Ohio, by the employees of the National Electric Lamp Company, with the co-operation of their employers. This company will invest its deposits in conservative stocks and bonds and will operate upon a conservative basis insuring a profit to the stockholders. For the purpose of handling common stocks and those considered not quite so sure, the Nela-Alpha Anticipation Company has been organized. The two, which have a combined capital stock of $500,000, will operate for the benefit of the employees who wish to see their savings making money for them.

* * *

WORLD'S PRODUCTION OF COAL.—According to the United States Bureau of Statistics, the United States is by far the largest coal producer of the world, its production in 1910 being 441,500,000 metric tons, against 264,500,000 by the United Kingdom, 222,000,000 by Germany, 39,000,000 each by France and Austria-Hungary, 24,500,000 by Russia, 23,000,000 by Belgium, 15,000,000 by Japan, 14,500,000 by China, 13,000,000 by Canada and 12,000,000 each by Australia and India, the grand total of production in 1910 for all countries for which statistics are available being a little over 1,000,000,000 tons, of which about 40 per cent is produced by the United States, about 23 per cent by the United Kingdom, and about 20 per cent by Germany.

* * *

GROUNDING THE SECONDARY.—The Northern Colorado Power Company has begun the systematic grounding of all secondaries on its lines in the large number of cities and towns to which its system extends. The company operates an all-day service in all of the towns, and in order to avoid duplication in secondary feeders employs an open-delta transformer connection, usually with 2200-volt direct primaries and 110-volt and 220-volt secondaries. After consultation between Mr. C. H. Williams, general manager of the company, and Mr. W. J. Canada, electrical engineer for the Underwriters, it was decided to ground the common leg uniformly, thus securing simplicity and avoiding possible mistakes if some intermediate point were chosen. Use will be made of water-mains for ground connection wherever available, and in outlying territory driven-pipe ground connections will be installed in groups.

* * *

THE DRAWN-WIRE TUNGSTEN LAMP.—Mr. C. W. Bender has called our attention to an error which appears in the account of his discussion of tungsten lamps before the Chicago Section of the Illuminating Engineering Society on page 1585 of the issue for Dec. 30. The statement that the drawn-wire tungsten lamp results in early blackening of the bulb is erroneous, according to Mr. Bender, the candle-power performance of the drawn-wire lamp being not only equal to that of the old pressed-filament lamp, but superior in that the bulb is not nearly so subject to early blackening through filament impurities and inequalities of the filament. Occasionally an old-type pressed-filament lamp is removed from service after having been in use for several thousand hours, but such a lamp can be considered as a freak from a great many lamps originally installed, and should not be taken as a criterion of pressed-filament lamp performance.

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PHILADELPHIA SECTION, I. E. S.—The largest meeting ever held by the Philadelphia Section of the Illuminating Engineering Society was the one on Jan. 19, when 243 members and visitors were present. The program was opened by a fifteen-minute educational talk by Prof. A. J. Rowland, director of the School of Engineering, Drexel Institute. By means of a few demonstrations with simple apparatus the theory of the origin of light waves, sound waves, etc., was made plain. The papers of the evening were: "The Architect and the Illuminating Engineer," by Mr. V. R. Lansingh, and "Illumination of Interiors by Daylight and by Artificial Light," by Mr. L. B. Marks. Mr. E. L. Elliott also addressed the meeting. Mr. Lawrence Vissacher Boyd, Mr. W. J. Serrill and Mr. R. B. Ely took part in the discussion, which was followed by a motion picture of "The House Electrical." Mr. W. A. Castor, superintendent of meters of the United Gas Improvement Company, exhibited some gas meters and explained their mechanism. The meeting was preceded by a dinner.

Railway Fuel Association.—The fourth annual convention of the International Railway Fuel Association will be held in the Hotel Sherman, Chicago, on May 22 to 25. Mr. D. B. Sebastian, Rock Island Lines, LaSalle Street station, Chicago, is secretary of the association.

* * *

New York Sons of Jove.—A "rejuvenation" of the Sons of Jove will be held at the Hotel Astor, New York, on Wednesday evening, Feb. 7. Mr. Robert L. Jaynes, reigning Jupiter, will be present. The dinner will be held in the Belvedere room of the hotel, which will accommodate 400 guests. All arrangements are in charge of Mr. F. E. Watts, statesman for New York, 463 West Street, New York City.

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New York Jovian Luncheon.—There were 154 Jovians and guests present at the regular semi-monthly luncheon of the Sons of Jove held in New York on Wednesday, Jan. 24. The speaker on the occasion was Prof. J. W. Jenks, whose subject was "The Economic Aspect of the Recent Trust Decision." Professor Jenks' talk dealt with the purely economic aspect of consolidation, sketching the benefits and disadvantages of large combinations of business enterprises.

* * *

Electric Club of Chicago.—At the meeting of the Electric Club of Chicago on Jan. 17 these officers were nominated for the ensuing year: President, Mr. A. A. Gray, *Electrical Review;* vice-president, Mr. P. R. Boole, Electric Appliance Company; secretary, Mr. W. M. Connelly, Electric Controller & Manufacturing Company; treasurer, Mr. John R. Harmon, Sanitary District; managers, Messrs. N. G. Hafner, Central Electric Company; D. W. Roper, Commonwealth Edison Company; N. F. Obright, Sanitary District; J. R. Cravath, *Electrical World;* James H. Delany, Cosmopolitan Electric Company.

* * *

Engineering Courses Without Tuition.—The board of trustees of the College of the City of New York has passed a resolution which makes it possible for properly qualified men over twenty-one years of age to avail themselves of the opportunities of pursuing special courses at the college without expense for tuition. Courses for men engaged in engineering work are offered in elementary and advanced mechanics and heat, elementary and advanced sound, light, electricity and magnetism, strength of materials, heat engineering, direct-current engineering, theory of surveying, practical surveying, woodworking laboratory, forge and foundry laboratory, turning and pattern-making laboratory, machine-tool laboratory, descriptive geometry, mechanical and architectural drawing. The term begins on Feb. 5. Dr. J. G. Coffin is making the arangements for the applicants.

* * *

Decorative Street Lighting and Electric Advertising.—A meeting of the committee on decorative street lighting and electric advertising of the Commercial Section of the National Electric Light Association was held at the Congress Hotel, Chicago, on Jan. 17. Those present were Messrs. W. H. Hodge (chairman), Chicago; C. W. Bender, Cleveland; C. L. Eshleman, Cleveland; A. Larney, St. Paul, members of the committee, and Eugene Creed, of New York, acting as proxy for B. W. Mendenhall, of Salt Lake City. Meeting with the committee were Mr. H. J. Gille, of St. Paul, chairman of the Commercial Section; Mr. Philip S. Dodd, secretary of the section, and Mr. E. L. Callahan, of Chicago. On the subject of decorative street lighting it was decided to issue an illustrated book or pamphlet, to be distributed by central-station companies among their customers. The subject will be treated from a non-technical point of view. Mr. Bender was made chairman of the sub-committee having this work in charge. There is an existing booklet in relation to sign work, prepared last year, so that it will not be necessary for the committee to take up this feature of the work again. However, a sub-committee, of which Mr. Larney is chairman, will make recommendations on electrical advertising and sign work, pointing out the particular features of interest that have developed during the year. Mr. H. I. Markham, of Chicago, was added to the sub-committee on electric signs as a practical man engaged in the manufacture and distribution of these appliances.

* * *

Electric-Service Company's Apparatus Used to Resuscitate Persons Overcome by Gas.—Using a time-honored expression, it may be remarked that by the irony of fate the new pulmotor of the Commonwealth Edison Company, of Chicago, has achieved its greatest prominence by its use in bringing back to life no less than four persons apparently dead from inhaling the gas of a rival illuminating company. The apparatus is frequently mentioned as "the oxygen machine," and is of a type which was described in the *Electrical World* of April 6, 1911. It is made in Europe, and the Commonwealth Edison Company has only recently secured one. The entirely successful use of the machine in the cases of gas asphyxiation mentioned has attracted a great deal of attention, and the central-station company declares that the apparatus is ready for the free use of anyone in Chicago when the emergency arises.

* * *

Electrical League of Cleveland Luncheon.—Mayor Newton D. Baker addressed 140 members of the Electrical League of Cleveland at a luncheon held at the Gillsy Hotel at noon on Friday, Jan. 19, the subject being "Night Freight Service Over Electric Lines." Mr. Baker advocates a two-track, high-speed road up the Cuyahoga Valley to the city limits, there connecting with an electric belt line and delivering cars to all interurban lines. This would bring about a cheaper rate and less noise and danger, while it would enable the interurban cars to effect a quicker freight and passenger service. He opposed the method of electric freight service urged by merchants before the City Council, on the ground that three-car trains would endanger lives and would be extremely noisy, while the terms of the proposed ordinance would give the Cleveland Railway Company practically a perpetual grant. Mr. David Aitkin, president of the league, announced that the members are making plans for entertaining the National Electrical Jobbers' Association, which will hold its convention in Cleveland on Feb. 14, 15 and 16.

* * *

St. Louis League of Electrical Interests.—Mr. Sam A. Hobson, Fort Wayne Electric Works, was elected president and Mr. Ell C. Bennett, *Electric St. Louis* and the *Jovian Bulletin,* secretary and treasurer of the St. Louis League of Electrical Interests on Jan. 12. The annual meeting was held at the City Club, and there was an attendance of 119. Mr. F. D. Beardslee, the retiring secretary and treasurer, made an interesting report. The receipts of the year were $3,434, including $223 on hand at the beginning. Of the receipts $2,410 was contributed by St. Louis electrical houses to the advertising account, and $1,653 was expended during the year in advertising St. Louis and its electrical interests by electric signs. The total expenditures were $2,586, leaving a bank balance of $848. The membership on Jan. 1 was 261, a net gain of twenty-eight during the year. There were twenty-two noonday meetings during the year, with average attendance of forty-five, besides eleven special events, including banquets, entertainments and inspection trips. Altogether, the record is one of which the wide-awake and energetic society may well be proud.

110,000-VOLT TRANSMISSION SYSTEM OF THE PROVINCE OF ONTARIO—IV.

Low-Tension Lines of the Hydro-Electric Commission, with Data on Erection of Poles and Their Equipment — Details of Telephone System Connecting Stations.

THE previous articles devoted to the work of the Hydro-Electric Power Commission of Ontario have dealt with the transmission of high-tension energy from Niagara Falls, Ont., to the various substations, and the last article was given over entirely to a description of the substation layouts. It now remains to describe the immense network of low-tension lines erected by the commission for the purpose of transmitting Niagara energy at reduced pressure to the various municipalities that have contracted for electrical energy with the commission. It will be understood, of course, that this series of articles has to do entirely with the work of the commission in the Niagara district, where the system has been completed and placed in satisfactory operation. The work described, however, forms only a part of the great scheme for the utilization of the water-powers of the Province by the Hydro-Electric Power Commission of Ontario. The commission has a contract with the Kaministiquia Power Company, of Fort William, for energy which is supplied over a 22,000-volt line to a transformer station in the city of Port Arthur. The Simcoe Railway & Power Company is also under contract with the commission for energy supply to Midland and Penetanguishene. These contracts are similar to that between the commission and the Ontario Power Company. The work mapped out by the commission embraces the entire Province and, besides the Niagara district, includes the Trent Valley district, the Lake Huron and Georgian Bay district, the Ottawa Valley and St. Lawrence districts, and the Algoma, Thunder Bay and Rainy River districts.

The Dominion government has recently granted the commission certain power rights in the Trent Valley at Dam 4 of the Peterborough division and at Dam 8 in the Ontario and Rice Lake division of the Trent Valley Canal, where a total of 6000 minimum hp is available. In addition, the commission is considering the development of power on the Ottawa River at Chats Falls, where a development of 40,000 minimum hp is possible, with an approximate capacity of 120,000 hp with storage. The commission plans to link up the Ottawa and Trent systems with the existing Niagara system, so that ultimately the older portion of the Province will be covered with a network of high-tension lines deriving their energy from the most economical sources of power.

In the recent elections thirty-five additional municipalities passed by-laws authorizing the purchase of electrical energy from the commission. Among these were the municipalities of Prescott, Peterborough and Kingston, situated in the far eastern part of the Province. The results of these elections show the public approbation of this government enterprise. Just at present the commission is devoting considerable time to an investigation of the application and employment of electrical energy in the rural districts.

LOW-TENSION TRANSMISSION LINES.

Power distribution from the substations on the high-tension transmission line is effected over low-tension lines connecting the various municipalities to the substations. The power is transmitted at either 13,200 volts or 6600 volts, the former voltage being used generally. The application and agreement for hydroelectric power from and with the municipalities usually, although not always, require the construction of a low-tension transmission line by the commission.

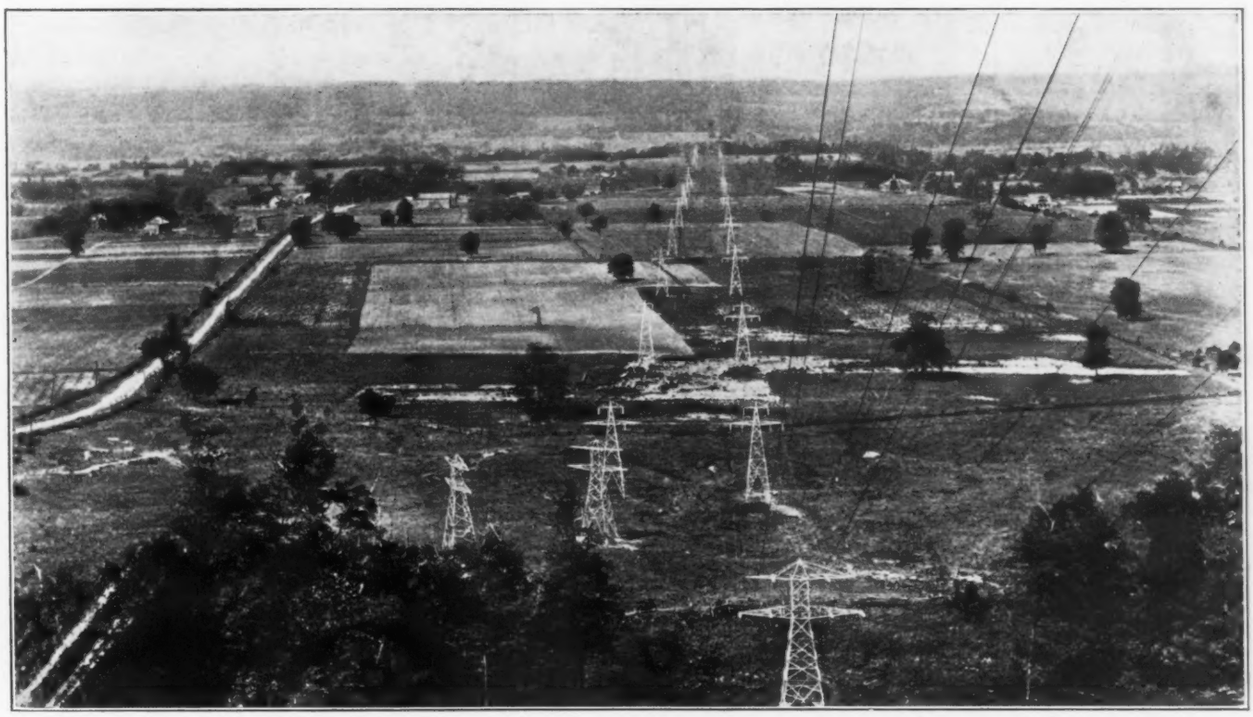


Fig. 40—General View of High-Tension Transmission Lines in Dundas Valley.

LOCATION.

As a rule the low-tension lines are parallel with the highways, although in some instances it is found either impossible or impracticable to follow this course and the route is necessarily carried across country. Contracts for right-of-way, and in some instances "short-cut" rights-of-way similar to those made for the high-tension transmission lines, are secured. The poles for the first low-tension transmission lines were located by survey stakes, but since then it has been found more satisfactory and economical to leave the location of the pole stakes to the foreman of construction. The poles are set in accordance with the

commission's low-tension-line specifications on an average 120 ft. apart, although some spans on the system are over 250 ft. in length.

FOOTINGS.

As has been previously mentioned, all poles are now located and staked by the foreman. The hole is opened by a man with a short-handled shovel and finished by a following-up gang with long-handled spoons and digging irons. The average 40-ft. pole is set in a 6-ft. hole. All corner poles are set from 7 ft. to 7½ ft. deep, according to the nature of the soil. Where soft ground is encountered a rock back-fill or a concrete footing is employed.

POLES.

Idaho or Canadian cedar poles, averaging in height 40 ft., butt diameter 14 in. to 20 in. and top diameter 7 in. to 8 in., are used. The poles are framed in the pole yard

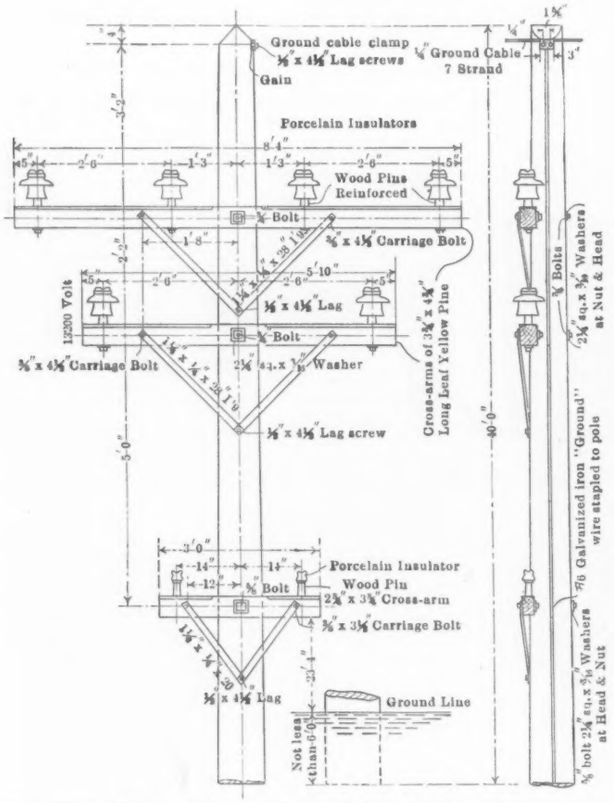


Fig. 41—Standard Pole Top for 13,200-Volt Transmission Line.

and the butts are impregnated with a preservative compound known commercially as "Solignum."

CROSS-ARMS.

The cross-arms are made of long-leaf yellow pine dressed with roofed tops and treated in hot creosote preservative. The standard arms provide for two and four pins.

INSULATORS.

Double-petticoat, post-type porcelain insulators are made use of for the low-tension transmission lines. Previous to their adoption they were submitted to a fifteen-minute dry test at 45,000 volts flash-over and a fifteen-minute wet test under a precipitation of ½ in. of water a minute at an angle of 45 deg., with 34,000 volts applied without break-down. These tests were performed in the station of the Ontario Power Company at Niagara Falls. Insulators are mounted on wooden pins provided with steel centers and bolted to the wooden cross-arms.

ERECTION.

The transmission poles were erected by a gang made up of from ten to twenty men. These men were followed by a cross-arm gang which assembled the insulators, pins and cross-arms and secured the arms to the poles. This gang also did the necessary guying and bracing and erected the ground wire at the tops of the poles. Following this came the stringing gang, which pulled out the cables three at a time with running board, raised them to the poles, adjusted the sag and tied in on the insulators with No. 4 B. & S. aluminum tie wire. This gang also erected the telephone circuits.

LINE.

Several sizes of aluminum cable are made use of, according to load and length of line, such as Nos. 1, 2, 0, 00, 000 and 0000, B. & S. seven-strand aluminum cable only being used for low-tension transmission. The poles, with their cross-arms (Fig. 41), are designed to support two three-phase circuits, a ground wire and the telephone circuit. In some instances only one circuit has been erected or is at present in use, provision having been made in arm spacing

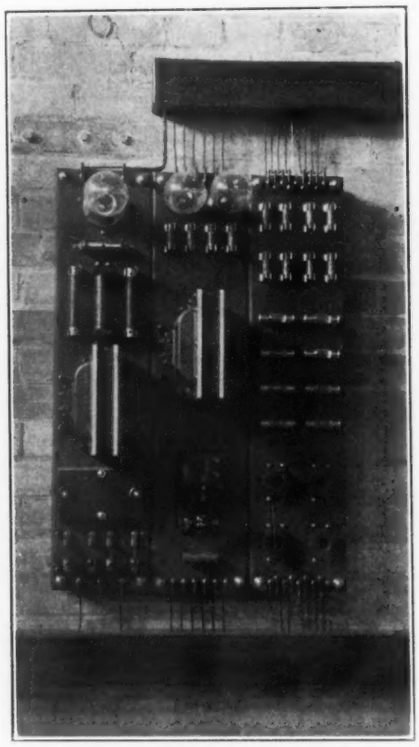


Fig. 42—Telephone Protective Equipment Panel.

for an additional two-pin arm. The ground wire is seven-strand galvanized-steel cable, approximately ¼ in. in diameter. It is erected at the top of the poles and secured to them by a specially designed clamp 3 ft. 8 in. above the upper transmission arm. The telephone wires are No. 8 and No. 10 B. & S. copper-clad steel wire. They are transposed every five poles by means of specially designed transposing brackets. All corner poles are double-armed, back-guyed and side-guyed. The greatest angle turned is 45 deg., two poles being placed with a short intervening span to avoid buck-arming. All cross-overs are protected by iron guard hooks attached to the ends of the cross-arms, while head, wind and special side guying are used as occasions arise.

Where railway cross-overs are encountered tandem twin-pole construction is used. The poles are back-guyed and tied together between power and telephone arms with cross-ties of yellow pine, and the adjacent spans are shortened. This construction is used to meet the regulations of the Dominion Railway Board, which require that all railway cross-over transmission wires shall have a minimum clearance of 35 ft. on a 145-ft. span, and 2½ ft. additional for

each 20-ft. increase in the length of the span, and twin-pole construction. At the present time there are about 176 miles of pole line and 8252 poles in the low-tension system.

TELEPHONE SYSTEM.

An extensive telephone system connects the various substations and municipal stations. The Niagara, Dundas, Toronto and London stations are what might be termed "terminal stations," since the telephone lines terminate on individual drops in the exchanges of these stations. Port Credit, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock and St. Thomas are through stations, and the exchanges are bridged across the main line and are operated as party-line stations. These are all located on a loop circuit, which can be sectionalized by means of specially installed switches in case of trouble without interfering with the other exchanges on the loop. Telephone connection to the municipalities in the system is made through the exchange boards of the various stations supplying power to them.

The telephone lines between substations are run on separate poles paralleling the high-tension system. The telephone circuits for the low-tension line are carried on the low-tension transmission poles 5 ft. below the lowest cable.

It was found that the high voltage used on the transmission system induced a potential in the telephone line sufficiently high to strain the insulation of the standard equipment beyond safe limits. Various types of protective equipment were at first employed, but were found unsatisfactory. After careful investigation and study of the conditions and requirements an entirely original protective equipment designed and standardized by the commission's engineers was installed. This equipment (Fig. 42) is mounted on special slate panels. It consists of indicating fuses, vacuum-type lightning arresters, auxiliary gap arresters, specially wound open-core choke coils, accurately balanced bleeding inductances and condensers. Since the installation of these protective equipments the operation of the telephone system has been entirely satisfactory.

SUMMARY.

The present and preceding articles have described essentially the electrical equipment of this system. The Dundas to Berlin section, being the first continuous line completed, was placed in test operation in September, 1910. The test was carried out at 55,000 volts above the highest designed operating potential of the system. This test proved conclusively that electrical energy might be safely and efficiently transmitted at 165,000 volts to localities at a radial distance of over 250 miles.

The formal opening of the system took place at Berlin on Oct. 11, 1910, the city being the first one in the Province to receive electrical energy transmitted over a distance of 100 miles at a potential of 110,000 volts. Sir James Whitney, Premier of the Province of Ontario, officiated. The other substations were placed in operation on the following dates: Dundas, September, 1910; Preston, Guelph and Woodstock, November, 1910; London and Stratford, December, 1910; St. Mary's, January, 1911; St. Thomas, February, 1911; Toronto, March, 1911, and Port Credit, June, 1911.

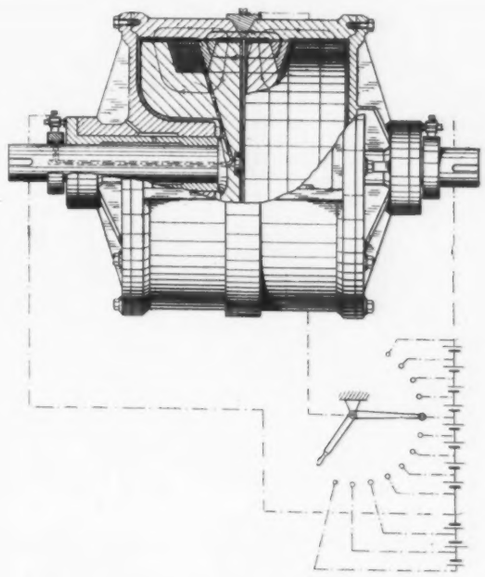
The commission plans ultimately to extend its system over the entire Province. Particular attention is being paid to the central and northern portions, since the water-powers of these districts have an aggregate horse-power of more than twice that of the Niagara district, which is practically the only one developed by the commission up to the present. Hydroelectric energy will shortly be supplied to municipalities in the St. Lawrence and Trent River districts.

The success of any large engineering enterprise is always due to a large number of workers rather than to an individual. In the present instance the work was intrusted to the able management of Mr. P. W. Sothman, chief engineer of the commission, assisted by Mr. F. A. Gaby, assistant chief engineer, and their staff of assistants, consisting of Messrs. H. G. Acres, F. T. Stocking, E. T. J. Brandon, A. E. Davidson, F. P. Mansbendel, P. W. Yates, J. A. Brundige, A. V. Trimble, T. U. Fairlie, W. L. Ainlay and C. J. McCormick.

In conclusion, it may be said that this project has met with unqualified success, since during fifteen months' operation there has been practically no interruption in the service. Various municipalities not on the provincial transmission system have applied for the control of the water-powers in their respective localities by the commission and eventual distribution of hydroelectric power. The commission is taking active steps to meet this demand, and additions to the present system are very shortly to be made.

ACYCLIC SPEED-CHANGING GEAR.

In a United States patent issued on Aug. 22 to Mr. Hans Kleinschmidt, of Berlin-Wilmsersdorf, Germany, was described an interesting form of speed-changing device built on the motor-generator principle using "homopolar" or "acyclic" machines. The only connection between the rotating and stationary members of the device is that of the electrical machines. The motor and the generator are



Acyclic Generator-Motor Speed-Changing Device.

of the acyclic type, built with their stators forming a common casing, in the interior of which revolve the rotors with their end-faces opposite each other. Each of the stators consists of an iron or steel band, these being connected with each other by means of a conducting non-magnetic (copper) ring, so as to form a common hollow cylindrical body. The rotors represent massive cylindrical blocks of iron or steel, each being provided with two radially projecting flanges, forming between them an annular groove of trapeziform cross-section, in which the field coils are placed. The air-gaps between the rotors and the casing and between the inner end-faces of the rotors are made as small as possible, and the air-gap spaces are filled with mercury for forming an effective part of the electrical circuit of the motor and the generator. The ratio between the speeds of the two rotors depends upon the relative excitations of the magnetic fields of the two machines, which can be varied at will by well-known means. The inventor states that the device is particularly suitable for obtaining a variable speed from a constant-speed motor for propelling vehicles, etc.

ELECTRICAL EQUIPMENT OF A GREAT GROUP OF OFFICE BUILDINGS—III.

A Description of the Main Contactor Board and Distributing System for Light and Motor Service in the Buildings of the Prudential Insurance Company at Newark, N. J.

By Henry C. Meyer, Jr., and Bassett Jones, Jr.

OTHER articles which appeared in two preceding issues were devoted to the history of the Prudential installation and certain construction details such as the engine-room equipment, busbar and switchboard equipment. In the present article is given a detailed description of the contactor board, the main distributing system and the general arrangement of feeder runs in all buildings.

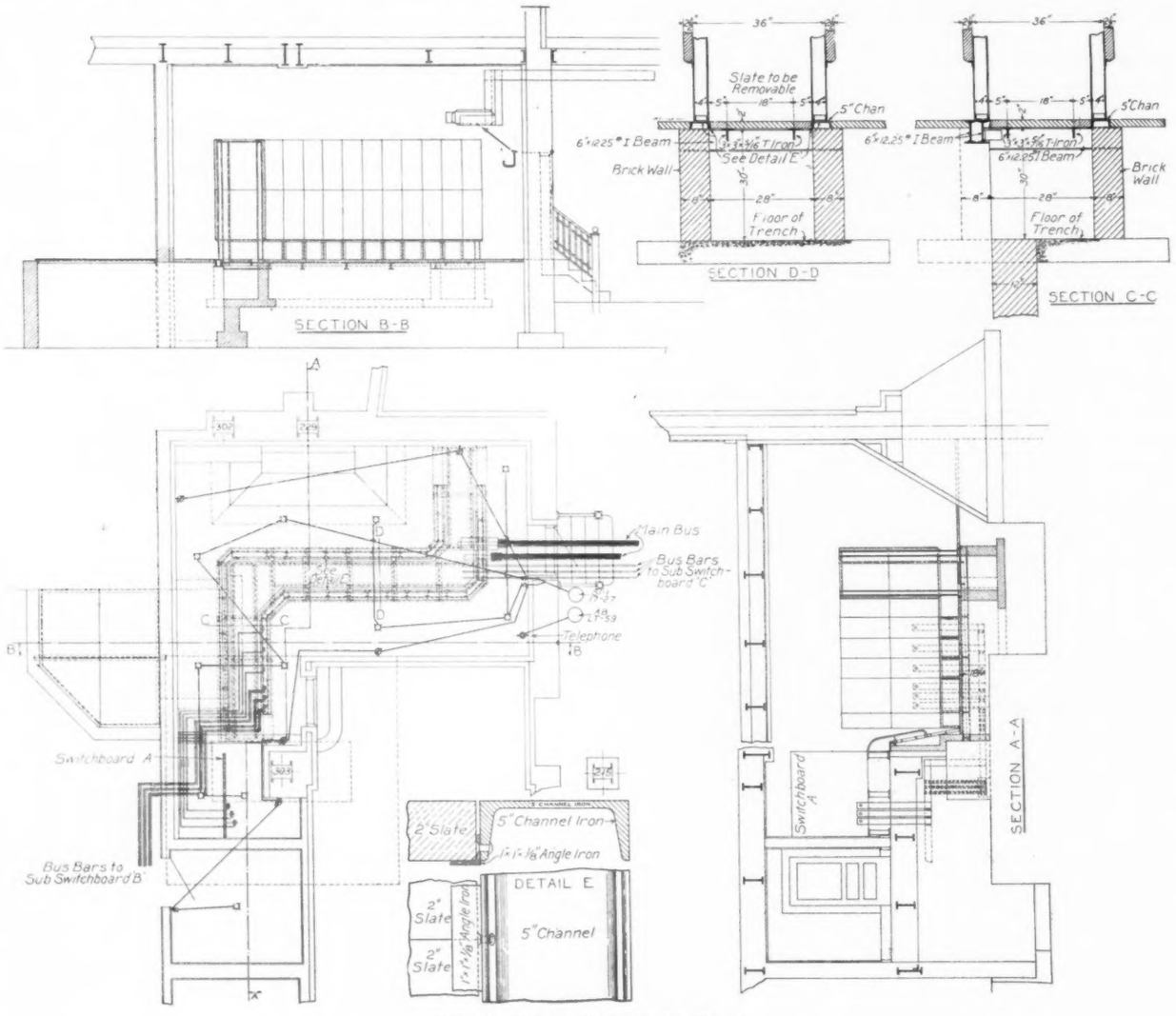


Fig. 27—Detail of Contactor Board.

MAIN CONTACTOR BOARD.

The main contactor board is located in a special room, as shown in Fig. 12. The board is in two parts back to back, and stands on retaining walls which provide a trench under the alley between the two parts in which the feeder buses and cables going east are run. This trench is covered by a removable slate floor slotted for buses and drilled for cables. The details of this construction are shown in Fig. 27.

The feeder cables and buses, control lines and main buses going west rise to the rack above the board and extend into the passage under the old boiler-room floor. Figs. 28 and 29 show typical diagrams of connections for various kinds of circuits.

Fig. 30 is a view looking up at *H* in Fig. 12 and shows the control-line conduits and "old-building" feeder conduits as they pass through the wall between the contactor-board room and the passage.

The main-station ammeter shunt is placed in one of the main generator busbars just inside the contactor-board room at *I*, Fig. 12, *J*, Fig. 27. This shunt is designed for a 250-millivolt drop at 8000 amp The main shunt leads to the control board are 750,000-circ. mil cables.

The contactors vary in rating from 100 amp. to 3000 amp, rated at 250 amp per square inch of actual contact surface and a maximum temperature rise of 18 deg. C. These requirements as to rating are made necessary by the unusually high constant room temperatures to which such apparatus is subjected in plants of this character. The larger contactors are operated indirectly through relays, the current required (25 amp) being too large for the control switch contacts.

The main busbars are run overhead, the connections to contactors being taken down as indicated in Figs. 21 and 22, which also show the contactor relays mounted in banks on the board frame.

The construction of this board, which, with all other switchboards in this installation, was built by the General

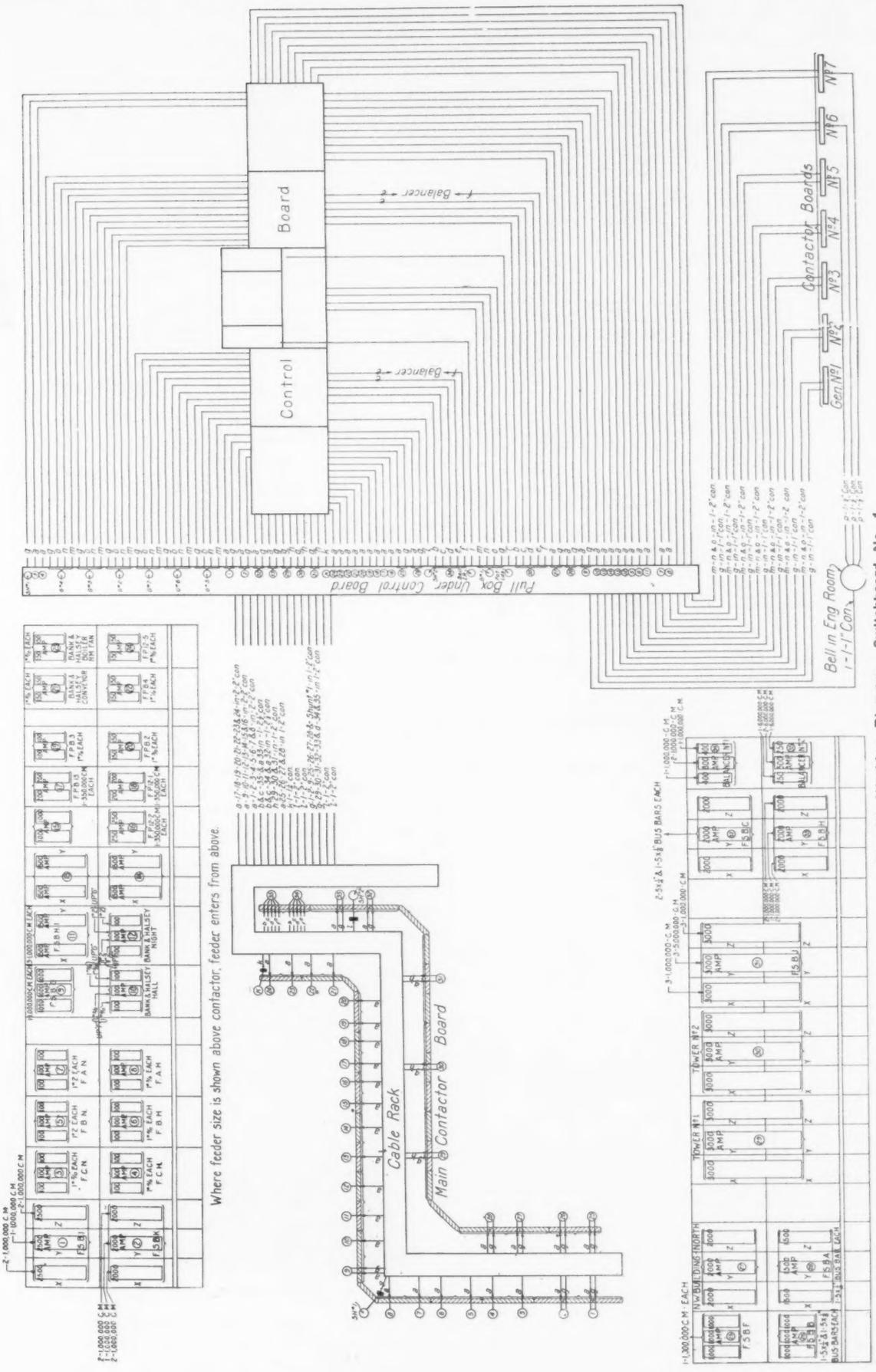


Fig. 28—Working Diagram. Switchboard No. 1.

Electric Company, is a remarkable piece of switchboard engineering. The cramped space conditions and the peculiar shape of the room available made it necessary to economize every fraction of an inch in dimensions, at the same time allowing ample margin for growth and increasing loads.

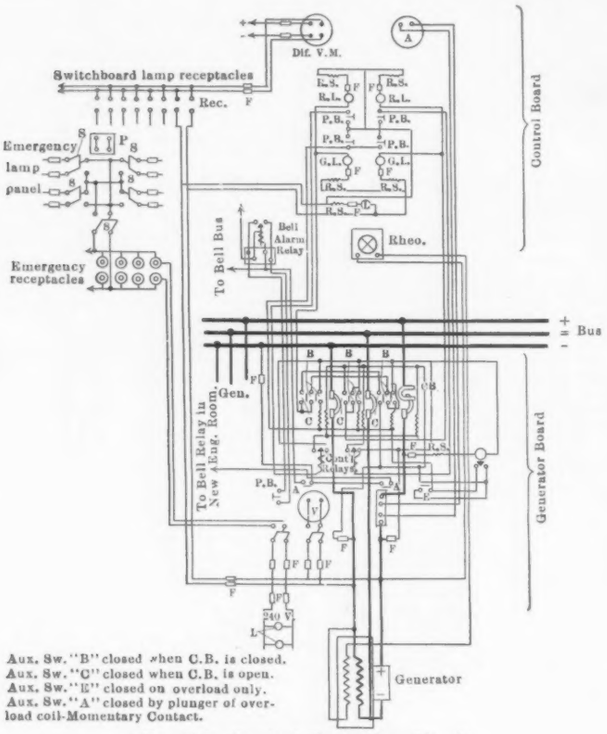


Fig. 29A—Typical Generator Circuit.

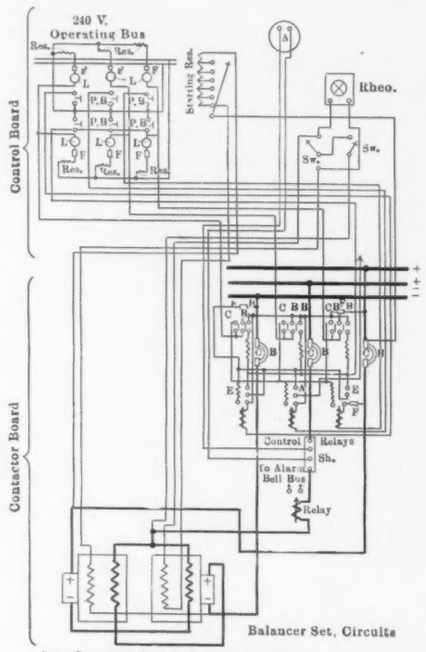

240 V. Operating Bus
Control Board
Contactor Board
Rheo.
Sw.
Control Relays
To Alarm Bell Bus
Relay
Balancer Set, Circuits
Aux. Sw. "B" closed when C.B. is closed.
Aux. Sw. "C" closed when C.B. is open.
Aux. Sw. "E" closed on overload only.
Aux. Sw. "A" closed by plunger of overload coil-Momentary Contact.

Fig. 29B—Balancer Set Circuit.

MAIN DISTRIBUTING SYSTEM FOR LIGHTING AND MOTOR SERVICE.

The main distribution for lamps consists generally of three-wire main feeders controlled by three-pole solenoid-operated circuit-breakers or contactors on the contactor board. These main feeders terminate at sub-switchboards at the foot of the several riser shafts from which the rising feeders deliver energy to the centers of distribution on the several floors.

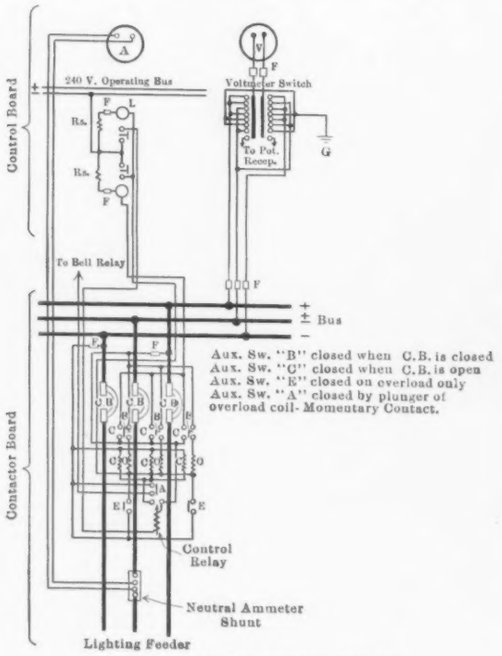
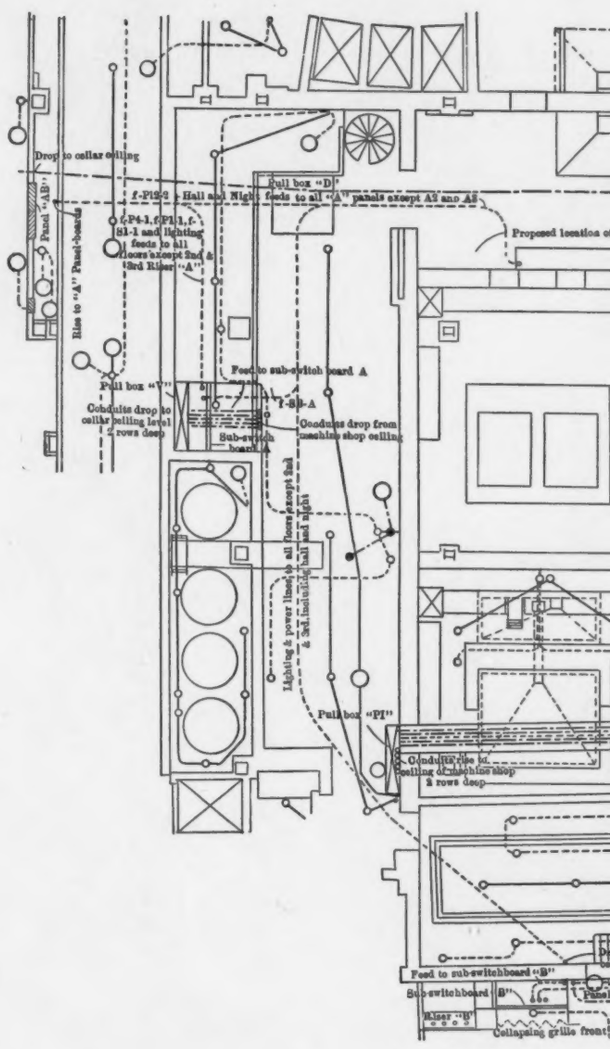

240 V. Operating Bus
Control Board
Contactor Board
Voltmeter Switch
To Pot. Recep.
To Bell Relay
Bus
Aux. Sw. "B" closed when C.B. is closed
Aux. Sw. "C" closed when C.B. is open
Aux. Sw. "E" closed on overload only
Aux. Sw. "A" closed by plunger of overload coil-Momentary Contact.
Control Relay
Neutral Ammeter Shunt
Lighting Feeder

Fig. 29C—Typical Feeder Circuit.

The distribution for motors consists of two-wire feeders run directly from the contactor board where service is intermittent or where direct control at the switchboard is required. For small motors and for portable devices the feeders are run from the sub-switchboards and are fed by the main lighting feeders. The only sub-switchboard for motor service alone is in the Northwest Building printing department.

The main lighting feeders in the additions to the North Building are in the form of busbars hung from the cellar ceiling and protected with wire-mesh grilles. Other feeders for lamps and motors to the old buildings are in the form of cables pulled in conduit.

Fig. 30—Conduit Detail (Looking Up).


Drop to cellar ceiling
Panel "AB"
Rise to "A" Panel-boards
Pull box "D"
Proposed location o
Pull box "V"
Conduits drop to cellar ceiling level 2 rows deep
Sub-switch board A
Conduits drop from machine shop ceiling
Lighting & power loops to all floors except 2nd & 3rd, including hall and night
Pull box "P1"
Conduits rise to ceiling of machine shop 2 rows deep
Sub-switchboard "B"
Riser "B"
Collapsing grille front

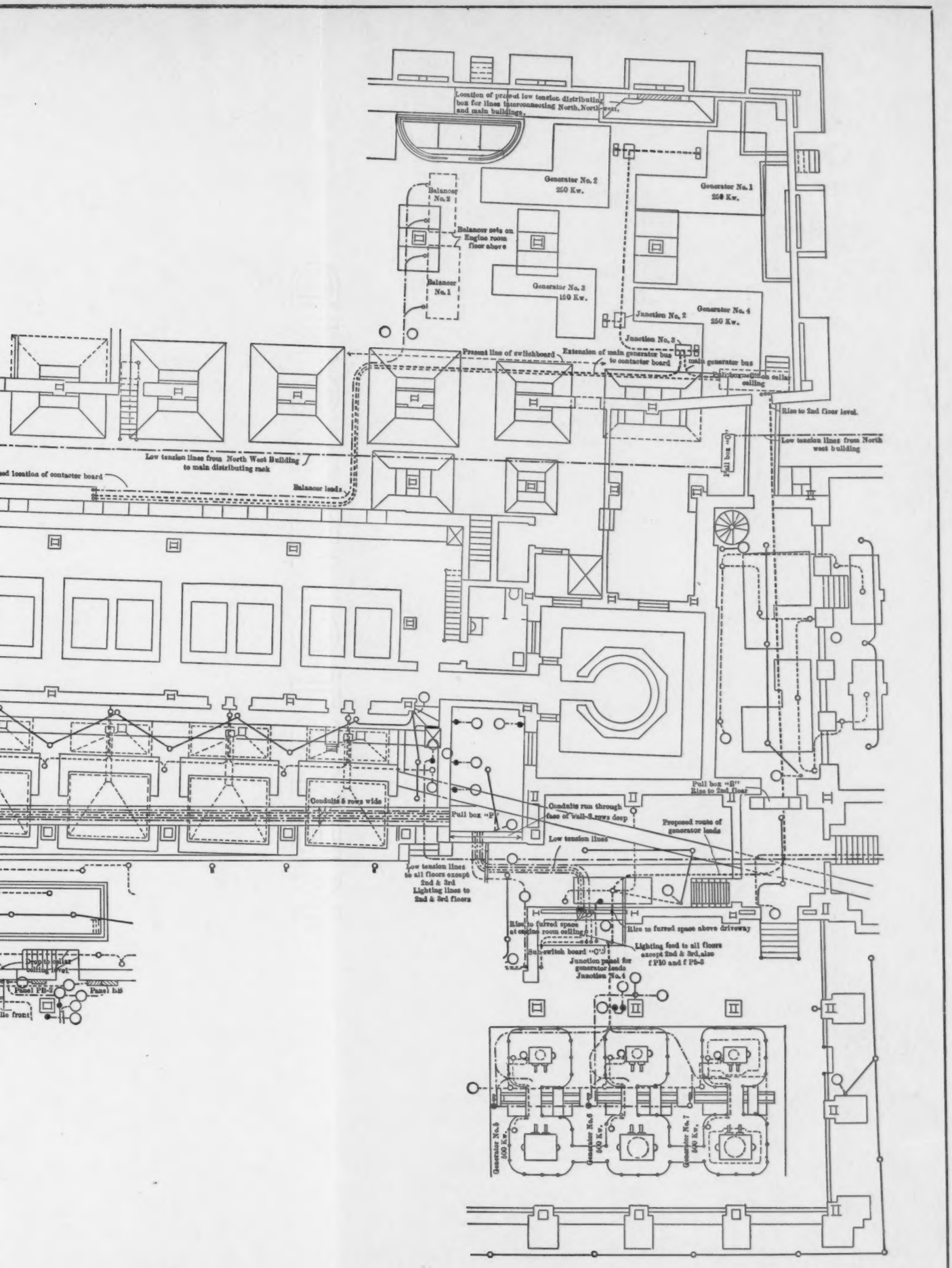

Location of present low tension distributing box for lines interconnecting North, North-west, and main buildings.
Generator No. 2 250 Kw.
Generator No. 1 250 Kw.
Balancer No. 2
Balancer sets on Engine room floor above
Balancer No. 1
Generator No. 3 150 Kw.
Generator No. 4 250 Kw.
Junction No. 2
Junction No. 3
Present line of switchboard
Extension of main generator bus to contactor board
main generator bus
Brickwork on cellar ceiling
Rise to 2nd floor level.
Low tension lines from North west building
Pull box "O"
Low tension lines from North West Building to main distributing rack
Balancer leads
Pull box "B" Rise to 2nd floor
Conduits 6 rows wide
Pull box "P"
Conduits run through face of wall-3 rows deep
Proposed route of generator leads
Low tension lines
Low tension lines to all floors except 2nd & 3rd Lighting lines to 2nd & 3rd floors
Rise to furred space at engine room ceiling
Rise to furred space above driveway
Lighting feed to all floors except 2nd & 3rd, also f P10 and f P5-3
Sub-switch board "Q"
Junction panel for generator leads Junction No. 4
Generator No.5 500 Kw.
Generator No.6 500 Kw.
Generator No.7 500 Kw.
Panel P8-3
Panel P5

Fig. 5A—Diagram Showing Electric Wiring of Basement and Proposed Bus Routes.

The general arrangement of the horizontal feeder runs in the cellar of the new building is shown in Fig. 9. The general arrangement of the feeder runs to the old buildings is shown in Fig. 31, which also shows the tunnels under Bank Street (see Fig. 3) and the subway before mentioned in the cellars of the old buildings. The difficulties overcome in the arrangement and installation of this distributing system to the sub-switchboards were very great. In the first place the cellars of the new buildings were designed for only 4.5 ft. head-room, which was entirely occupied by steam and water pipes and ducts. In the short time available for study before it was necessary to begin the actual work of construction the unsatisfactory and almost impractical route indicated in Fig. 5A was laid out, as it appeared to be the only route available. As soon as the contracts were awarded, however, detail studies were begun with a view to bettering these conditions. A great amount of energy and thought was expended in examining various possible routes and in making detail drawings of such routes in the attempt to fit the quantity of material required into

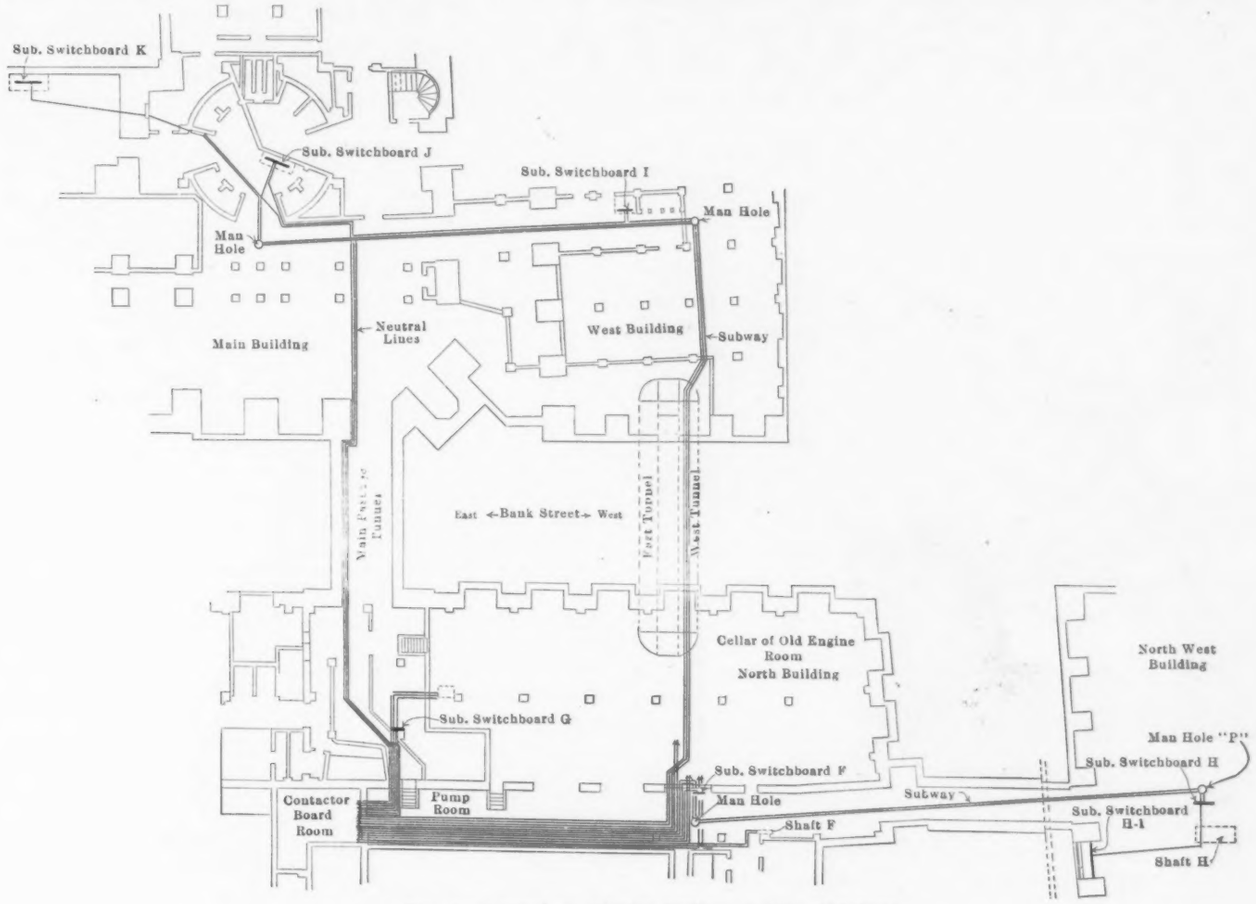
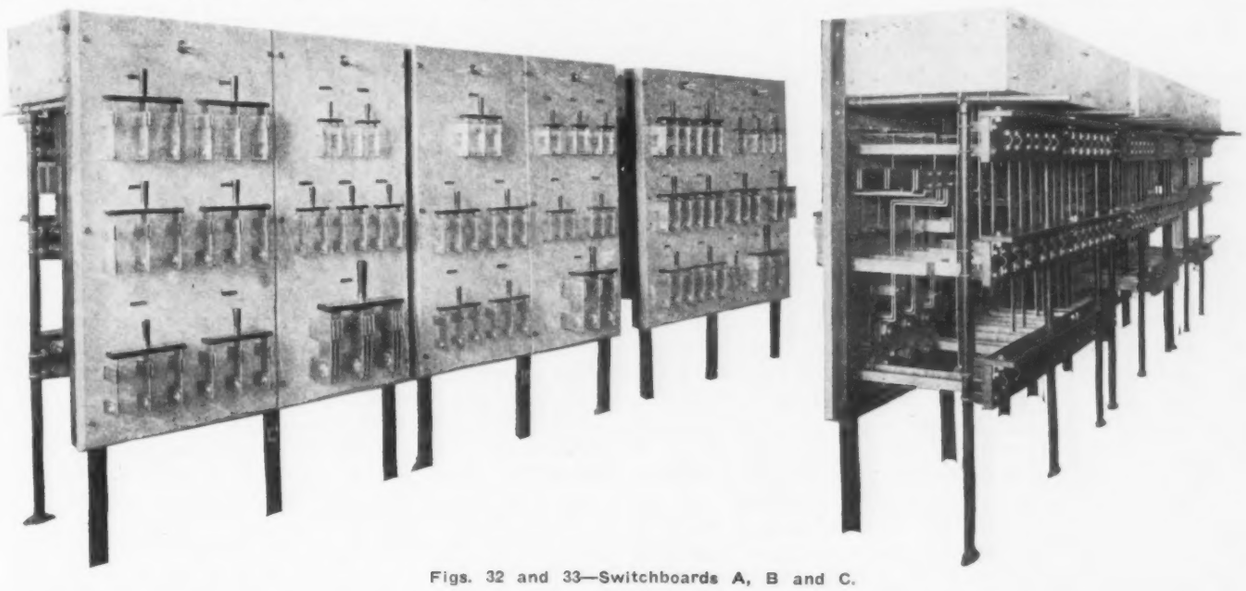


Fig. 31—Layout of Feeder System to Old Buildings.



Figs. 32 and 33—Switchboards A, B and C.

the space obtainable. Finally the level of the cellar floors was dropped an additional 4 ft., making the maximum head room 8.5 ft. Even with this additional space crowded conditions at several points were found to exist to such an extent that it was finally decided to do away with conduits and cables as far as possible and to use bare buses. With conduits and the numerous unavoidable bends and offsets the pulling of cables would have been practically impossible.

The feeder buses to sub-switchboard B as they pass out of the contactor-room trench are shown in Fig. 34. Parts of these buses and the feeder buses to sub-switchboard A, where located in the contactor room, are shown in Fig. 27.

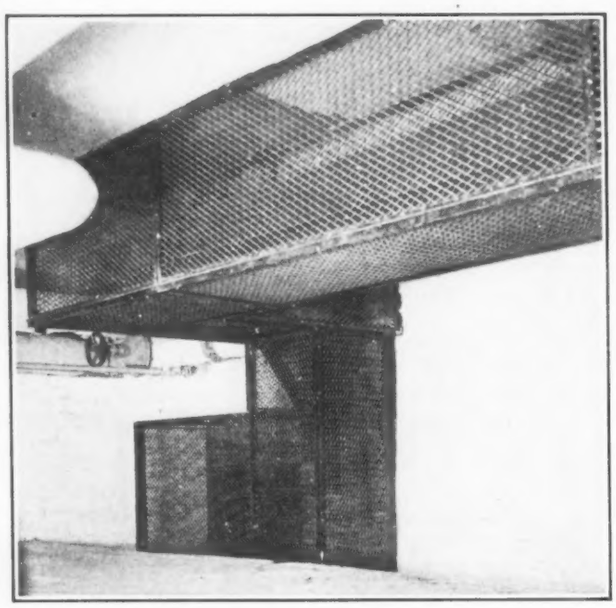


Fig. 34—Feeder Busbars and Cage.

The feeder buses to sub-switchboard C, in the new engine-room, extend back over the route of the generator buses as shown in Fig. 9.

The original feeders from the old buildings were run in conduit under the cellar floor of the old engine-room to a pull-room under the old switchboard. These conduits were built in under the old engine foundations so that it was impossible either to remove them or add to them. No space was available for running the neutrals in the old engine-room cellar or in the subway, so these lines were run overhead to the buildings on the south side of Bank Street through the east or main passageway tunnel, as indicated in Fig. 31.

The general character of the sub-switchboards is shown in Figs. 32 and 33, where the three sub-boards A, B and C are set up side by side. These boards have an unfused main three-pole knife switch and fused three-pole and two-pole feeder switches. The feeder fuses are open links of composition placed on slate fuse slabs supported at the rear of the board. Bus extensions from the fuse slabs terminate at lugs inside the slate pull-boxes supported behind the upper part of the board. The riser conduits terminate in these pull-boxes, and the feeder cables are there distributed and connected to the proper lugs.

This series of articles describing the electrical equipment of the Prudential Insurance Company's buildings will be continued in the issue of Feb. 10. In future issues will be described details of the distribution system for light and motor service, such as pipe work, subway systems, vertical chases, etc., distributing system for telephones and signaling, sub-distribution systems, and special appliances devised for this particular work, such as floor boxes and other devices.

WIRELESS TELEGRAPHY ON THE ATLANTIC COAST OF THE UNITED STATES.

By James L. Charlton.

On the Atlantic seaboard of the United States there are fifty-four wireless-telegraph stations fully equipped, all of which are operated by the United States army and navy, the United Wireless Telegraph Company, the Marconi company and the United Fruit Company, divided as follows: Twenty-two by the navy, seven by the army, sixteen by the United Wireless, seven by the Marconi company and two by the United Fruit Company. In addition to these the navy operates five stations in the West Indies and Central America, the United Wireless three and the United Fruit Company six. The government stations are primarily for departmental service, although under certain conditions some of the naval stations—for instance, Key West, San Juan and Colon—are also open for commercial business. In addition to the above there are a number of stations used for experimental purposes or operated by other companies and by private individuals, but their influence is wholly local. At best they are of little importance except to cause interference with the transaction of government and commercial business. To this statement there is one exception, namely, the station of the *New York Herald* situated at the Battery in New York Harbor, which stands ready at all times to give aid to navigation and twice daily sends out weather reports and news items. By constantly improving and weeding out defects the above-mentioned stations are to-day in first-class operation and do an amount of work daily that would no doubt surprise the average person.

The naval stations extend from Cape Elizabeth, Maine, to Key West, Fla., with two on the Gulf Coast—one at Pensacola, Fla., and one at New Orleans. There is also a high-power station at Guantanamo, Cuba, the winter base of the Atlantic fleet, and there are two stations at the Isthmus, situated one at Colon and one at Porto Bello. By relaying a message may be sent from one extreme of the navy circuit to the other without the slightest doubt that the message will reach its destination. The speed of transmission and the amount of relaying vary at different times of the year, due to the influence of atmospheric electricity during the summer months in the southern zones. Although this obstacle has been overcome to some extent by increased efficiency of operation and the use of high-frequency sparks, it is still a source of great annoyance.

Besides handling the official business of the navy and keeping war vessels anywhere within 500 miles of the coast almost constantly in touch with the department at Washington, the naval stations send out a noontime signal each weekday, followed by the weather report for the vicinity in which the station is located, and also, when storms are brewing, warnings received from the Weather Bureau. Ships in distress can always call these stations.

The equipment of the navy stations varies and numerous types of apparatus are used, although the receiving is almost entirely done with perikon detectors and transformer, telescopic-type tuning coils, a carborundum or silicon detector being cut in when there are strong static effects or a ship close by is signaling.

The high-power stations at Key West, San Juan, Guantanamo and Colon are equipped with high-frequency sending sets of 35-kw rating, and were designed to be intercommunicative; in fact, they are so during the night and under favorable conditions during daylight. The navy yard stations located at Brooklyn, Washington, Charleston and Pensacola are of from 10-kw to 15-kw rating and have an effective range of about 500 miles. Sending sets of 3-kw to 5-kw rating were installed in the other naval stations, while most of the fortifications and lightships have 1-kw sets.

The Navy Department is gradually developing a standard transmitting unit, which will overcome some of the defects in the present equipments and be capable of transmitting with a wide range of wave lengths. A transmitter capable of a wide and quick change in wave lengths is very desirable; for in case of war and with the enemy trying to interrupt wireless communication, the wave lengths could, by a prearranged schedule, be changed until communication was established. In some of the sets being tried out on shipboard this is done with a very loose coupling and by plugging in sections or individual turns on the closed circuit helix. A variation of wave lengths from 300 m to 1100 m and in some cases 2000 m has thus been used in cases of strong interference with good success.

The Navy Department has now a standard mast or tower for antenna suspension and will gradually replace the old wooden poles at all of the important shore stations. It is constructed of light angle iron and built in the form of a pyramid, being 9 ft. square at the base and tapering to 2½ ft. at the top. Surmounting the top is a short wooden mast to which the antenna insulators are attached. The mast from base to extreme top is 200 ft. high and rests on a wooden insulated platform. The recent equipment of the Newport station with two of these towers placed 550 ft. apart has made that station one of the most important on the coast and has greatly extended its range of operation, with a record of communication with Colon, Panama, a distance of nearly 2000 miles.

The new naval station now under construction at Arlington, near Washington, will have three towers, one 600 ft. and the others 450 ft. high. The equipment of this station will be ideal in every respect and when completed it will be one of the most powerful in the world. A twenty-four-hour watch is stationed at all naval shore stations year in and year out, there being as a rule four operators with a chief operator in charge.

Since the passage of the wireless-telegraphy act, effective July 1, 1911, there has been necessarily a large increase in installations on ships of all descriptions, and a great many of these installations have been by the United Wireless Company, which, in conjunction with the United Fruit Company, controls nearly all the commercial wireless business to and from steamers operating on the Atlantic coast of the United States, Mexico, Central America and the West Indies. Twenty-one of the United Fruit Company steamers carry wireless stations, and the Atlantic division of the United Wireless Company operates some 240 stations aboard vessels. An effective chain of commercial stations extends from Eastport, Maine, to Galveston, Tex., the average distance apart being 200 miles, consequently coastwise shipping is at all times within range of shore communication. It may be added that the Key West naval station handles the messages in that vicinity for both the United and the Marconi company.

The United Wireless equipment for ships is a standard set of 2-kw rating with direct-coupled transmitter and tuning coil, the receiving being done with carborundum detectors. The more important commercial shore stations, such as Eastport, Sparrow's Point, Cape Hatteras, Tampa, New Orleans and those in Central America, are of 5-kw to 10-kw rating, while the intermediate stations are of 2-kw rating. Taking into consideration the rating of the sets, this company does excellent work and has a system of relaying that is very satisfactory.

When at sea, ships with United Wireless equipment make daily reports of their 8 a. m. and 8 p. m. position, and handle messages from ship to shore or vice versa. A news bulletin is published once or twice a day, and on ships that are at sea for a day or more at a time these bulletins are inserted in an attractive booklet and sold as a souvenir. The press items for the bulletin are sent out by Atlantic City, Norfolk, Hatteras and Key West stations between 8 and 10 o'clock each morning, and at night by Atlantic City at 8:30 p. m., and by the *New York Herald* station at 9:15 p. m., which repeats at 12:30 a. m.

While the United Wireless Company monopolizes practically all the north and south commercial wireless business of the Atlantic coast, the Marconi company similarly monopolizes the transatlantic business. This company has seven stations on the Atlantic coast; four of these are bunched close together between Cape Cod, Mass., and Sea Gate, L. I. Of the others, one is at Cape May, N. J., one at Virginia Beach, Va., and the other at Palm Beach, Fla. These last three stations have only lately been installed. The Marconi company does a big business in messages and works very effectively. There are about eighty transatlantic ships which have Marconi installations, none being in excess of 2.5 kw. These ships do not individually do much long-distance sending, such communication being by relay, as there is practically always a chain of ships stretching across the Atlantic.

Three stations handle the New York business, namely, those at Siasconset, Mass.; Sagaponack, N. Y., and Sea Gate, N. Y. Cape Cod handles the Boston end, Cape May the Philadelphia end and Virginia Beach and Palm Beach handle the business from any Marconi ships that happen to be bound south. There are also three stations on the southern coast of Nova Scotia which receive or transmit messages to the United States by land wire.

With the exception of Cape Cod, none of these stations are of high power. At Cape Cod (Wellfleet, Mass.) there are two stations, one of high and the other of low power. The low-power station is used for local work during the day and the other, which is of 75 kw and has a wave length of 1800 m, is used for press and long-distance messages at night. The large antenna of the high-power station is used only for transmission and not for receiving messages. This station has a duplicate at Poldhu on the western coast of England and each station has a maximum radius of transmission of about 1500 nautical miles. When midway across and when there is no abnormal static effect the liners often copy the press messages from both sides during the same night.

Marconi operators are furnished with a magnetic detector for medium-distance work, and for long-distance work the Fleming vacuum-tube rectifier is used. This detector was brought out some years ago, but met with little success until lately, when improvements were made, and it is now equally sensitive with the perikon detector, although not nearly so simple. This rectifier consists essentially of an incandescent lamp of about 5 cp, the filament of which is brought to incandescence by a battery, usually of storage cells giving from 12 to 18 volts, there being a certain critical point which is controlled by a variable resistance placed in series with the filament. Surrounding the filament is a platinum plate connected to a leading-in wire fused in the opposite end from the filament. When one lead from the receiving circuit is connected to one terminal of the filament and the other lead to the platinum or cold electrode, the oscillations in the antenna are caused to pass only in one direction through the rectifier, thus producing a direct current, which is made to act upon a telephone in the receiving circuit.

In all Marconi calls there are three letters and all begin with an "M," except in the cases of German subscribers to the Marconi service, whose calls begin with a "D." About eighteen months ago the navy also inaugurated a three-letter call system, as the similarity in many of the two-letter calls was causing great confusion. Now all its shore stations on the Atlantic coast have calls beginning with "NA" and on the Pacific with "NP," the ships' calls beginning with "NB," "NC," "ND," etc. The United Wireless stations for the most part use two-letter calls. Marconi operators use the Continental code exclusively, the United Wireless operators the American Morse, and the navy operators must know both.

Central Station
Management, Policies and Commercial Methods

Display Lighting in Fort Smith.

Two years ago Garrison Avenue, the principal street of Fort Smith, Ark., had fifty-four signs, containing 3000 2-cp lamps. At the present time 146 signs are in service, containing a total of 11,000 lamps. In addition twenty-one five-lamp tungsten curb clusters have been installed, besides thirty-eight flaming-arc lamps, bringing the total Garrison Avenue lighting up to a connected load of 184 kw, compared with 31 kw two years ago.

A New Use for Electric Irons.

By H. W. Brunell.

The owner of the electric flatiron may save a plumber's bill in cold weather when the radiator freezes in the following manner: Place the flat side of the iron against the radiator, allowing the handle to rest upon the top of the valve; then insert a piece of wire through the radiator coils and around the iron, to hold it in position. When the current is turned on the heat from the electric iron melts the ice in the coils and heats the water, and the hot water flows downward by force of gravity, clearing the pipes of ice. This method has worked out successfully several times and will possibly assist someone who would rather add slightly to a meter reading than contribute to the wealth of the plumber.

A SPECIALIZED NEW-BUSINESS DEPARTMENT, OR EACH MEMBER OF THE STAFF A SOLICITOR?

At a recent convention of central-station men the question was raised whether a specialized new-business department is really needed in the average community, the point being made that, instead, every member of the company's staff should be imbued with the idea of securing new customers, considering this duty as part of his regular work. One speaker declared that the various members of the force come into contact with a great number of possible customers and should be able to interest these in central-station service. A plant engineer or a lamp-trimmer, for example, may furnish splendid "tips" as to where new business may be had, and should, of course, receive credit for his suggestions.

There are objections to awarding cash bonuses to such employees, according to some operators, for the men should realize that all their efforts to further the company's interests are wholly within their own line of duty. But a word of encouragement and appreciation, a hearty slap on the back or an occasional cigar will not be amiss in expressing the manager's recognition. Taking the other viewpoint, one central-station operator has had good results from his policy of giving his meter readers $2 for each new customer closed through their efforts, as well as 10 per cent of the amount of the consumer's yearly contract. In another city the meter reader has occupied his spare time selling and delivering electric irons, placing as many as fifty a month in this way. In some places, it was pointed out by the speaker who raised the original question, there is really not enough to keep a specialized new-business solicitor or solicitors busy.

The new-business men present at the meeting took vigorous exception, of course, to any views tending toward their own elimination. One solicitor pointed out that what is everybody's business turns out to be no one's. Specialists are needed in every field to-day, he insisted. No capable man can afford to divide his time among a number of variant duties. Such a policy results only in a scattering of efforts with little effective work accomplished. In many instances specialized selling ability or special knowledge of the customer's needs is needed to secure the contract, and it is here that the trained solicitor, profiting by his experience with other similar installations and his familiarity with plant data, can render the greatest service to the central station.

Meter and Key Postal Cards.

The Louisville Lighting Company, of Louisville, Ky., having found that business was sometimes very slow in coming from vacant houses which had previously been equipped with meters, has adopted the expedient of attaching a pasteboard tag to a wire or pipe where it will be easily noticed in the event of the new tenant coming to look the situation over. The tag contains a detachable post card for mail communication with the lighting headquarters. One side of the card says: "Electric light and power in this building furnished by the Louisville Lighting Company. Telephone contract department. Both 'phones. If you want service tear off this post card and mail, signing your name and address."

The other side of the card is directed to the lighting company and contains a blank space for remarks or requests for information from headquarters.

The cards have been found of distinct value in hastening business which might otherwise be slow in coming. Some lighting companies post a placard near the place of the meter, but the mailing card, which originated with Mr. J. J. Leverone, of the company, is considered much more effective. A similar plan soon to be put into effect is an arrangement with all of the realty men in the city whereby advertising cards from the lighting company will be attached to all keys issued from the real-estate offices to prospective tenants of vacant property.

CENTRAL-STATION GROWTH AT DETROIT.

Central-station service in American cities is enjoying a growth which surpasses even the most sanguine expectations of a few years ago. In no city has this development been more rapid than in Detroit, where, as the accompanying curves show, an increase of nearly 35 per cent per year has been effected. Recent notes in the *Electrical World* have recorded the large monthly number of new contracts closed by the sales department of this company.

The accompanying load curves and records of connected load illustrate the rapid increase in generating-plant capacity which has had to be provided to keep pace with the growing demand. The recent development of Detroit as a factory city is responsible in a measure for the unusual increase of commercial load, and the resulting influx of factory employees has developed the residence service in the newer sections.

Fig. 1 shows a series of average load curves of the Detroit system, taken at about the same dates of the years from 1906 to 1911 inclusive. Fig. 2 records the increase in total kilowatt-hours' output, total commercial kilowatts connected, number of meters, and the total horse-power of

motors, both direct-current and alternating-current, for the years 1903 to Nov. 1, 1911.

In addition to its own lighting and commercial load, the Detroit system furnishes energy for the associated Eastern

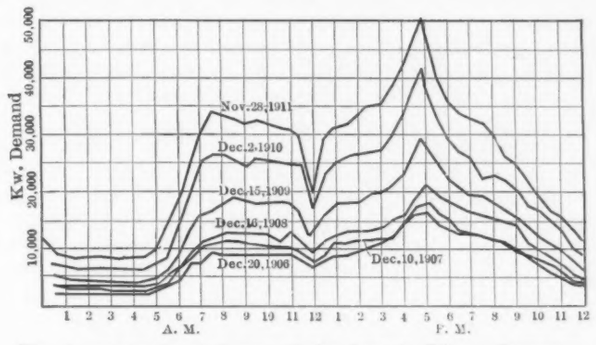


Fig. 1—Yearly Load Curve of the Detroit Edison Company.

Michigan Edison Company, operating in the suburban district surrounding Detroit. About one-fifth of its total generated output is purchased by the Detroit city railways for operating cars in all outlying sections of the city. Another unusual traction load taken over by the central-station company within the year is the operation of the Detroit River tunnel of the Michigan Central Railroad. The tunnel sub-

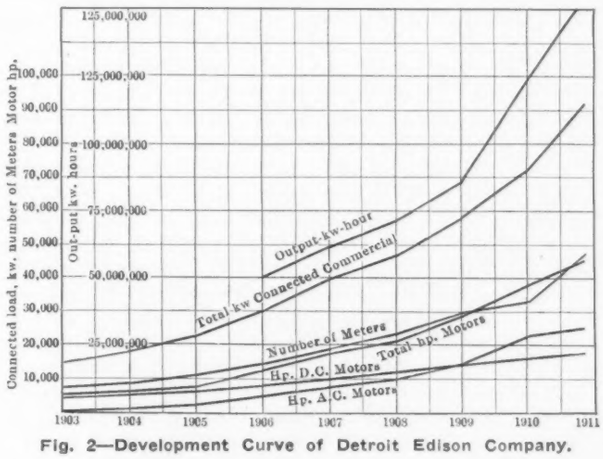


Fig. 2—Development Curve of Detroit Edison Company.

station takes its energy supply through a 500-kw motor-generator set, being arranged with a storage battery so that the peaks of demand of train acceleration are not felt by the central-station system.

ELECTRIC SIGNS IN SAN DIEGO, CAL.

On Dec. 1, 1910, there were on the lines of the San Diego (Cal.) Consolidated Gas & Electric Company sixty-nine electric signs containing 5706 lamps with a connected load of 53.2 kw. On Dec. 1, 1911, the total number of signs had increased to 175, with 12,391 lamps and a connected load of 133.1 kw. Thus there was a gain in the number of signs of 154 per cent, in the number of lamps of 117 per cent, and in connected load of 150 per cent. The number of signs on flat rate on Dec. 1, 1911, was ninety-six and on metered rate seventy-nine.

Classified as to type the 175 signs mentioned are divided as follows: Painted grooved letter, thirty-eight; Federal sectional, thirty-six; American Sign Company (Bullseye), twenty-nine; inclosed transparencies, sixteen; painted flush letter, fourteen; reflector type, fourteen; panel type, twelve; outline, ten; miscellaneous, six.

Standard 16-in. Federal sectional enameled steel signs are installed at 18 cents per 5-watt lamp per month. The sign becomes the property of the customer at the end of two years. This rate also includes energy until 11 p. m., lamp renewals and patrolling. These signs are all horizontal and extend over the sidewalk. They average ninety-one lamps to the sign, and the total number of letters is 383, an average of 5.6 letters to each side of the sign. This gives an average of 8.1 sockets per letter, which is less than the figure usually used in estimating. The average cost per sign of this type installed complete, including all wiring, lamps and transformer, has been $164.80, thus giving a net cost of $14.60 per single-faced letter installed or $1.80 per socket installed. Allowing 7 per cent interest for one year, this means a net investment of 8 cents per lamp per month, which leaves a balance of 10 cents per lamp per month to pay for renewals, energy and patrolling. The patrol cost is 1.1 cents per lamp per month. Renewals, based on a lamp life of 1000 hours, cost 4.2 cents per lamp per month. Thus the San Diego company is receiving 4.7 cents per lamp per month for electricity, or 6.3 cents per kw-hour. It is probable that the life of the 5-watt tungsten lamp is considerably in excess of the 1000 hours estimated, and therefore the net income per kilowatt-hour from these rental signs is probably greater than that given. These signs are cleaned periodically by the company during the dry, dusty summer.

The principal metered signs are American signs of the Bullseye type and glass or other transparencies. However, flat rates covering these signs have been established recently. Although flat rates are proportionately cheaper than metered rates, the company finds that its revenue is increased by the flate rates, owing to the fact that the metered signs are urned off, as a rule, much earlier than the flat-rate signs. Signs of the American type in San Diego contain 637 lamps, all but forty-four being 25-watt tungstens. The average number of lamps per sign is twenty-two, and the average watt consumption per sign is 570.

There are several special and spectacular signs in San Diego, and an interesting installation of this type is in the form of a cabinet containing advertisements of the principal merchants. This sign is lighted by sixteen 40-watt and forty-four 25-watt tungstens and is operated by a ¼-hp motor.

During the closing months of 1911 a number of signs were remodeled, the old 10-watt, 2-cp carbon lamps being replaced by 5-watt, 4-cp tungstens. At the same time the signs were repainted and generally put in good condition, without expense to the customer, provided a two-year renewal contract was obtained at the old rate for the carbon lamps. By this means some dissatisfied customers have been placated and poorly maintained signs have been transformed into effective advertisments.

Business houses which seem to afford the best prospects for sign business in San Diego are, in the order of their importance, as follows: Hotel and lodging houses, saloons, restaurants, theaters, clothing and dry-goods stores, shoe stores, automobile garages. Of course, there is a long list of miscellaneous customers in addition to these.

Mr. L. M. Klauber, of the San Diego company, says that the success of that company in sign soliciting is due mainly to continuous application. A card index of prospective customers, with reports of calls, is kept, and they are visited at regular intervals. Sign solicitors are equipped for selling signs. They are supplied with curves and data which permit them to give a prospective customer estimates of dimensions, maintenance costs and sketches at a moment's notice without the necessity of preliminary figuring. The sign data book is found to be useful. If a cheaper sign than the Federal is desired, the solicitor can quote prices from a local manufacturer on any size of grooved or flush sign hung ready to light.

As the salesman is supplied with complete data, but little of the merchant's time is wasted in waiting for him to figure on different propositions and the merchant's enthusiasm is

not allowed to abate while waiting for designs and estimates. In general it is found best to give the customer definite and concise information as to first cost and maintenance and then to translate these figures into the increased daily business necessary to pay for the sign. This figure is generally surprisingly low, and when it is mentioned it will close many a contract.

THE BRITISH CENTRAL-STATION PUBLICITY COMMITTEE

By T. W. Cole.

The development of the central-station industry in England presents a good many points of interest. These chiefly center, of course, about the various engineering and commercial problems which have been involved there, and about the ways, successful or otherwise, in which they have been grappled. The engineering problems are entirely omitted in the present discussion, since for the moment the interest in the engineering side must take second place with the commercial.

The commercial problems, so far as England at least is concerned, are only partly solved. Moreover, the future success of the central-station industry depends upon the good or bad policy which will be displayed during the next few years in tackling the purely commercial development. Fortunately, in England a start has already been made in the right direction, but it is, broadly speaking, only a start. This movement, which contains in itself immense potentialities, is the establishing of the Electric Supply Publicity Committee of Great Britain. A few years hence the forming of this body will doubtless be universally recognized as marking one of the most important junctures in British central-station history.

The committee has now been established a year and a half. Its work is to further the commercial interests of the 500 central stations of Great Britain, including both private and municipal plants. The actual executive work is carried out by a general committee composed of the managers and engineers of the leading electric companies and municipal plants. This general committee is unique in that it is composed solely of managers who control the commercial side of great undertakings, many of which are the largest in the country. Besides the great practical experience this body is potentially a very powerful and influential organization, since its decisions represent the commercial policy of the foremost companies. The chairman of the committee is Mr. H. B. Renwick, general manager of the County of London Electric Supply Company, Limited, and managing director of the Coatbridge & Airdrie Electric Supply Company, Limited; the Richmond Electric Light and Power Company, Limited, and the Bournemouth & Poole Electricity Supply Company, Limited. The honorary secretary is Mr. F. J. Walker, general manager of the St. James' & Pall Mall Electric Light Company, Limited. The vice-chairman is Mr. A. C. Cramb, chief engineer of the Croydon Municipal Electric Supply Authority. The members of the general committee are: Messrs. F. Ayton, Ipswich Corporation Electric Supply; G. G. Bell, Borough of Hammersmith Electric Supply; L. E. Buckell, Newcastle-upon-Tyne Electric Supply Company, Limited; J. Christie, Brighton Corporation Electric Supply; R. S. Erskine, the Kensington & Knightsbridge Electric Lighting Company, Limited; A. F. Harrison, the City of London Electric Lighting Company, Limited; E. Cunliffe Owen, the Metropolitan Electric Supply Company, Limited; R. G. Rawkins, the Notting Hill Electric Lighting Company, Limited; L. L. Robinson, Borough of Hackney Electric Supply; E. Sayer, Borough of Hampstead Electric Supply; A. Hugh Seabrook, Borough of St. Marylebone Electric Supply; E. Wilmot Seale, the Charing Cross, West End & City Electricity Supply Company, Limited; N. Staniland, Borough of Hornsey Electric Supply, and J. E. Tapper, Beckenham District Council Electric Supply.

The work of this committee consists in producing all kinds of advertising literature for the use of central stations, including posters, show cards, booklets, mail cards, leaflets, pamphlets, folders, circulars, etc. Seasonable literature is thus issued at frequent intervals, the announcements being mailed, with specimens, to each central station throughout Great Britain and Ireland. By thus co-operating under careful management the highest class of advertising literature can be produced and the services of really first-class artists commanded. The literature issued by the committee has reached a standard of excellence never before approached in the electric industry of Great Britain. Furthermore, with such large issues, appealing to large clientèles, the cost is reduced to the lowest possible figure. The circulation has now reached very large proportions, as the majority of the leading central-station authorities in the United Kingdom depend for their advertising almost solely on the committee's publications. The cumulative effect of this widespread circularizing and postering throughout the land, on a single subject at a seasonable time of the year, cannot be overestimated.

Co-operative newspaper advertising forms another feature of the committee's work. Advertisements and articles are prepared and inserted in the leading newspapers, this work representing, of course, a most important supplement to the campaign opened by the circulars and posters. There is also the work of watching the interests of the electric companies in the daily and weekly press. The papers are carefully scrutinized from day to day, and any statements which are inimical to the electrical interests are immediately investigated and the facts laid before the editors. Other signal services have been rendered in the way of prompt contradiction of reports of fires wrongly attributed to electrical causes. The value of a central, authoritative body thus representing the industry throughout the country and able to act at a moment's notice cannot be esteemed too highly, and even during the comparatively short time since the committee's establishment it has been recognized on all sides as performing a necessary and valuable work. Not long ago almost every fire was attributed to electrical causes, but the committee now holds the balance in this respect and keeps the press carefully and correctly informed.

In the committee's wider range of work are included periodical conferences, where problems of publicity in relation to commercial development are discussed and broad lines of policy decided on. A publicity journal has also been instituted, which will deal with advertising matters and with approved methods of developing the industry. Articles will be contributed by central-station managers and engineers. Another aspect of the committee's organization is the study of the merits of apparatus on the market. In electric cooking, for instance, the extension of electric service is bound up with the reliable character of the apparatus, as well as its being marketed at a popular figure. At such a point the interests of both companies and manufacturers converge, so that a mutual understanding will facilitate the task of perfecting apparatus. Through some such representative body as the publicity committee one may look for this desirable *rapprochement*, and there is every prospect that the near future will see some such steps well afoot.

Those familiar with central-station history in Great Britain generally agree that the new publicity committee holds great promise. The commercial aspect of the business has at last been accorded its proper place, it being recognized that the central station is a trading concern and that its sales must be energetically and persistently pushed by advertising, canvassing and all the other business

methods adopted where the object is the sale of wares. The importance of this co-operation has been demonstrated by the results following even this short period of co-operative effort.

Wiring and Illumination.

SOME FACTORS IN HETEROCHROMATIC PHOTOMETRY.

By Louis Bell, Ph.D.

Every investigator who undertakes the comparison of lights differing strongly in color faces his task on each new occasion with a feeling of considerable discouragement. Small color differences are easily managed by any of the ordinary photometric methods, at least with a sufficient degree of precision for commercial measurements. When the color differences are great it is the general experience that different kinds of photometers give different relative values for the colored lights, and even the same photometer used in two different ways or at two different distances may fail to give concordant results. If the comparisons are repeated on another day, the chances are that results will not be very accurately comparable with those first obtained, and, what is worse, the general conclusions reached by one observer do not fully concur with those reached by another.

Such differences, which have been repeatedly noted, have commonly been charged to the Purkinje phenomenon, which has served as a sort of general scapegoat for unexplained discrepancies in color photometry, but as a matter of fact the illuminations concerned are often still well above the point at which the Purkinje phenomenon becomes conspicuous. An investigation of the ratio between ruby-red and signal-green lights, certainly distinct enough in color to show the Purkinje phenomenon effectively, made by so careful an observer as Mr. J. S. Dow (*Phil. Mag.*, August, 1906), shows that the true Purkinje phenomenon was practically insignificant when using a Lummer-Brodhun screen even down to 0.025 ft.-candle. Investigations by other methods of the point at which cone vision passes into rod vision show concordant results and render it exceedingly improbable that one could get the Purkinje effect at the intensities where color discrepancies are often found. Moreover, even granting that a perceptible error may be charged to this source, it still does not account for the material differences often observed as between the Lummer-Brodhun screen and the Bunsen screen, even when the angular fields are substantially the same, so that the "yellow-spot" effect is negligible.

It is the purpose of this article to call attention to a frequent source of error in heterochromatic work to which very little attention has been paid. This is the direct effect of simultaneous contrast in modifying the apparent luminosities of two colored lights under comparison, which under ordinary circumstances produces a sort of spurious Purkinje effect, not in the least related to the genuine phenomenon, occurring at much higher illuminations, and in some cases vanishing or perhaps even changing sign.

Every one who has worked at all with colors is familiar with some of the phenomena of simultaneous contrast. When red and green lights, for example, are in juxtaposition the red looks redder and the green greener to a very notable degree if the circumstances are favorable. These contrast colors are very familiar in the observation of double stars, and as the writer recently showed (*Astro-Physical Journal*, Vol. XXXI, page 234 *et seq.*), simultaneous contrast, in combination with modifications due to fatigue and dazzle tints, is responsible for nearly all the apparent brilliant colors noted in such objects.

The general laws of simultaneous contrast as laid down by Titchener ("A Textbook of Psychology," page 76) are substantially these: The contrast effect is always in the direction of greatest opposition in colors. It increases with the saturation of the more prominent color, and is always greatest when there is no simultaneous brightness contrast. Further, the nearer together and the less separated by visible boundary lines are the surfaces the sharper is the contrast effect.

Another curious phase of the matter is the insistence of these contrasts when once established. For example, if one puts on an ordinary photometer bar a 60-deg. right prism with a white surface and an edge toward the eye and lets fall upon it from one end of the bar the light of a mercury arc in a dark room, the impression created is not at all the green usually associated in the mind with that illuminant, but rather the faintly bluish white which one sees in looking directly at the tube. Similarly, if one begins at the other end of the bar and lights the other side of the wedge with a common incandescent lamp, the light seems the usual pleasant yellowish white. But when both lamps are in action the colors on the wedge become instantly a conspicuous green and a brilliant orange, neither in the least resembling the color apparent in the use of either illuminant by itself. And, what is more, the illusion of intense color cannot be shaken off, as Helmholtz long ago showed was the case under similar circumstances.

The writer recalls seeing two adjacent windows in a distant office building lighted respectively by a mercury tube and incandescent lamps, and in this instance, as in the case of some double stars, the colors had gone over to what

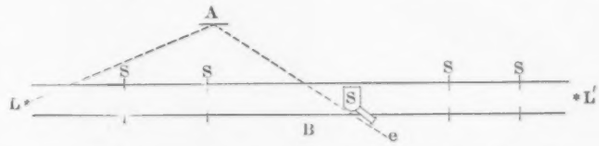


Fig. 1—Photometer Arrangement with Lummer-Broadhun Screen.

was apparently a pure and beautiful green, almost what the spectroscopist would call an "E green," and to a vivid orange red, respectively. These or any other similarly contrasted colors tend to be thrown apart in the spectrum and to change hue in a very startling manner.

This is precisely the condition which one confronts in the use of a Lummer-Brodhun screen. The lights from the two ends of the bar are placed in sharp juxtaposition without a dividing line between them and pass instantly from their wonted hues to conspicuously different color tones; the yellowish of an incandescent lamp, for example, becomes a full orange, and if the lamp is run at somewhat low voltage it passes to a full red under the effect of the contrast, while a mercury arc or other greenish source gets greener and greener under the contrast.

Fig. 1 shows an experiment which strikingly exhibits the change in hue produced by the Lummer-Brodhun screen. Here B is the photometer bar, L and L' are the sources of light, $s\,s\,s\,s$ the customary dark screens, and S the Lummer-Brodhun sight box. Now put any two contrasting lights at L and L', say a light-red and a light-green lamp. The color contrast on the screen immediately becomes very strong. Then place at A a dark target, having as its bull's-eye a white-paper circle of such a size as to subtend the same angle when seen from e, the eyepiece of the telescope, as does the central spot in the Lummer-Brodhun field. The rays from L fall upon and illuminate this circle, which, seen foreshortened, is substantially a duplicate of the central image and illuminated by the same light. The eye at e can pass quickly from one to the other or even see the two simultaneously, and the difference in hue is sometimes very striking. It is hardly possible to believe that both are diffuse reflections of approximately the same in-

tensity from white surfaces illuminated from the same source, so great is the effect of the contrasted surrounding field in the sight box.

In the case of a common incandescent lamp at L with a greenish contrast at L' the central field of the sight box is conspicuously deepened in hue. The same sort of thing happens when the sight box is reversed and the screen A put in a corresponding position. The two colors in the field have been thrown apart in a very conspicuous manner, the one toward the red, the other toward the green. The colors as seen have been shifted from their original places on the luminosity curve and have been pushed, the one toward a deeper tone of red, the other toward a somewhat fuller green.

The immediate question arises as to whether this change in apparent luminosity of hue due to simultaneous contrast is a real change as regards one's judgment of equality of brightness. Is the eye deceived in this respect as it is in the real color of the object seen?

A very simple experiment shows that precisely this thing

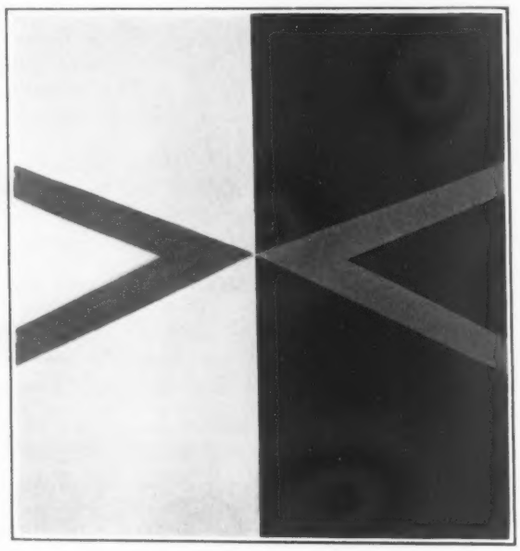


Fig. 2—Black, White and Gray Contrast-Test Object.

happens, so that in the presence of simultaneous contrast one's judgment of brightness may go all wrong. To reduce the problem to terms of simple brightness the writer prepared a test object such as is shown in Fig. 2, which is merely Hering's well-known contrast figure. It consists of a rectangle, half of black and half of white paper, on which are pasted two V-shaped pieces of a neutral tint with their points touching at the line of intersection between black and white. These in the experiment mentioned were cut out of Nendel's standard gray No. 10. At the first glance the gray V upon the black surface is much brighter than the gray V upon the white surface.

Now the photometer was set up as in Fig. 3, where B is the photometer bar, L and L' the sources, $S\,S\,S\,S$ the ordinary intercepting screens, and W the 60-deg. right prism already referred to. Over the front faces of this was smoothly stretched the test object shown in Fig. 2 with the intersection of the black and white paper precisely at the front angle of the wedge. With 100-cp tungsten lamps at each end of the 2.5-m bar a balance proved to be practically impossible, despite the fact that the two V's under observation were of precisely the same paper and when in the middle of the bar under precisely the same illumination, the two lamps having been previously adjusted by means of a Lummer-Brodhun screen. No position of the wedge could be found in which the V on the black background was not conspicuously more brilliant than the other.

The eye, in fact, could not form even an approximate judgment of the real brightness relation sustained by the objects looked at in the presence of simultaneous contrast. No objective difference of luminosity could overcome the subjective difference set up by contrast. One therefore is forced to the conclusion that subjective differences affecting

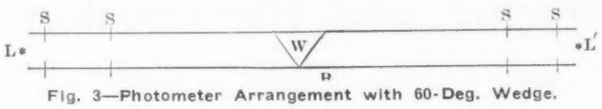


Fig. 3—Photometer Arrangement with 60-Deg. Wedge.

apparent luminosity are real differences when it comes to making a photometric balance. Of course in using a Lummer-Brodhun screen, for example, the shifting of apparent luminosity due to contrast is much less than in the case of the Hering test object, but the experiment of Fig. 1 shows the reality of the phenomenon.

The notion of spurious luminosity values due to simultaneous contrast is at first a rather startling one, but a few experiments will convince the investigator that it has a very real basis. One of the simplest, which has many times fallen under the writer's observation accidentally, is catching simultaneously the reflection, say of a gas flame, in the plain surface of a mirror and also in its beveled edge, in which one sees simultaneously the simple image of the flame and its image drawn out into a short spectrum. Now, obviously the flame must be the brighter, but in point of fact the central part of the spectrum, a somewhat impure yellow, uniformly looks brighter than the direct image, being intensified by the contrast of its strongly colored margins. Also, there is undoubtedly some effect due to the whitening, from impurity, of the central portion of the spectrum relatively to the whole source, with the accompanying impression of brilliancy that the mind associates with whiteness. Be that as it may, the spurious brightness acquired is altogether striking.

Fig. 4 conveys an approximate idea of the thing which happens in such a case. This figure shows the luminosity curves for equal distribution of energy at high and at low intensity based on the curves of König. Considering curve 2, that for relatively high intensity, let us suppose that we are comparing two lights of the spectral regions a and b respectively. When thrown upon the Lummer-Brodhun screen the hues are changed by contrast so that the red grows redder and the green greener. The contrasts therefore correspond to colors of lessened luminosity, but lessened in unequal degree. Diagrammatically the shift might be supposed to be from a to a' and b to b' respectively. But from the form of the luminosity curve in the regions affected the luminosity of the red is relatively the more depressed and photometric balance based on the

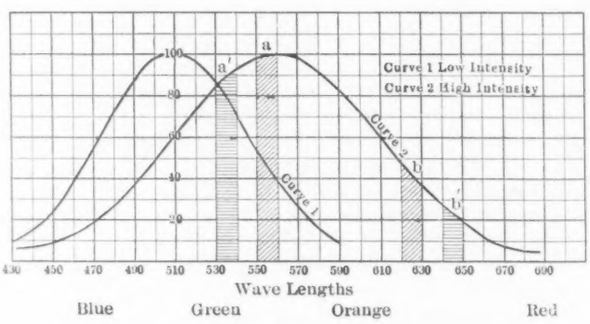


Fig. 4—Luminosity at High and Low Intensity.

contrast values would show an apparent Purkinje effect at illuminations much higher than those within which the real Purkinje effect comes into play.

It is a well-known fact of physiological optics, however, that as the illumination increases considerably even spectral colors get relatively less saturated and consequently would

affect each other less by simultaneous contrast, so that with increasing illumination the spurious Purkinje effect would be diminished. As one approaches the lower limit of color vision, on the other hand, the whole group of color phenomena is less conspicuous, including the effects of contrast, so that there would be a gradual merging into the actual Purkinje effect when the critical intensity at which rod vision is dominant is reached. Of course the magnitude of the relative depressions of luminosity in the two portions of the field must depend also on the actual colors involved, so that the result on photometric measurements would necessarily vary in a somewhat erratic manner, and it is quite possible that in comparing two lights of relatively pure colors conditions would be reached in which the result would be almost independent of contrast, or there might be even a small reversed Purkinje effect.

The actual error which is produced by the variation of luminosity through contrast may therefore conceivably be in either direction and of a magnitude depending on the particular colors contrasted, on the fatigue of the eye for color, which modifies the effects of the contrast in a very material degree, on individual differences in color perception, which are commoner than is generally supposed, although usually small, and on the general color adaptation of the eye, which is a function of what it has been doing previous to the presentation of the contrast.

As in the case of an ordinary illuminant the red side of the luminosity curve is somewhat the steeper, the usual errors which are introduced by contrast are likely to be of the nature of a spurious Purkinje effect and probably serve to explain the many observations of a supposed Purkinje effect in photometry at illuminations higher than those which are now known to be connected with the actual failure of cone vision. It seems altogether probable that a large proportion of the aberrances found between different observers and with the same observer at different times in using equality-of-brightness photometers are mainly due to the phenomena here considered.

Now, whatever else may be said of the properties of the flicker photometer simultaneous contrast is the particular thing eliminated by its use. The color flicker disappears before the brightness flicker, and when the balance is actually determined by the disappearance of the latter the colors have blended into a combination tone from which simultaneous contrast has disappeared. In fact, Dow (*Phil. Mag.*, August, 1906) has found that one can make pretty consistent settings without using the flicker phenomena at all, merely from the blending point of the colors.

Hence the flicker method gets rid not only of at least the major part of the Purkinje phenomenon itself, but of the spurious effect of contrasting apparent luminosity. It does not, of course, get rid of the difficulty which may be encountered when the apparent angle subtended by the color field is varied, nor of any inherent errors in color perception on the part of the observer.

Ives has shown in a beautiful series of researches (*Trans.* I. E. S., Vol. V, page 711) that in comparing the light of an incandescent lamp with various pure spectral colors both by the equality-of-brightness and the flicker method the results were fairly concurrent, so long as the fields judged were identical in diameter and the illumination fairly strong. He found, of course, various discrepancies in the equality-of-brightness comparisons by various observers and by the same observer at different times, which discrepancies were diminished in using the flicker instrument. Most other observers have found larger differences than Ives, but generally in comparing lights varying rather more strongly in color, as in matching a pronounced red with a pronounced green, in which case the contrast effects are, of course, very conspicuous. A similar reduction of color difficulties has been noted in the case of Bunsen or Leeson screens when so proportioned that there would be a marked color blending in the central field and thereby a considerable reduction in contrast. This point has been brought out by Sharp ("Baltimore Lectures," Vol. I, page 488) and also in a paper by Pole (*Trans.* I. E. S., 1911, page 334).

The general facts disclosed by this investigation are substantially as follows: The uncertainties of using equality-of-brightness photometers for the comparison of lights differing widely in color are notorious, and it very rarely happens that the results obtained by photometers of different kinds are coincident. Discrepancies of the apparent nature of the Purkinje phenomenon and amounting to considerable percentages have been noted by many observers, even at intensities much higher than those at which the Purkinje phenomenon should appear.

Whenever two colored fields are brought into juxtaposition they affect each other by simultaneous contrast, tending to throw the color tones further apart. For example, a green and a red under contrast change hues conspicuously, the red getting a fuller and deeper red and the green a more conspicuous green. The contrast tones thus acquired are those corresponding to different positions on the luminosity curve from the original hues.

In making a judgment of brightness such as has to be made in an equality-of-brightness photometer the eye can depend only on what it sees and therefore makes its judgment on the apparent colors which it sees as influenced by contrast. Hence, if the contrast is of such a character as to shift the effective luminosities of the two color fields by unequal amounts, a color error will be introduced in the setting, and since the red side of the luminosity curve is usually steeper than the green side, the net result in comparing colors is often to produce a spurious Purkinje phenomenon perceptible even at fairly high illuminations. Even when this effect does not exist, the shifting of colors by contrast along the luminosity curve still takes place, and since different observers and the same observer at different times vary in perception of simultaneous contrast small and shifting color errors are constantly introduced in photometric observations which bear no relation to the genuine Purkinje phenomenon or to the absolute color sense of the individual observer. Perhaps the strongest claim of the flicker photometer rests on its freedom from errors of this kind, due to the fact that color blending is secured at a lower frequency than corresponds to the disappearance of brightness flicker, and in fact the flicker photometer is the only form in which simultaneous contrast is fully eliminated, which is another good reason for employing it in heterochromatic comparisons.

RECENT TELEPHONE PATENTS.

NEW TRANSMITTERS.

A transmitter of the inverted solid-back type has been patented by Mr. H. P. Clausen, of Chicago. The body of the granule box is formed of a flanged ring, the flanges being riveted to the diaphragm. The front electrode is secured to the diaphragm by a threaded stud. The usual clamping ring secures an auxiliary mica diaphragm to the body to close the box, the rear electrode being carried by the auxiliary diaphragm. The bridge carries the stud of the rear electrode in a socket bushed with insulation. This patent is assigned to the Stromberg-Carlson Telephone Manufacturing Company.

Mr. J. H. O'Connell, of Boston, has removed the usual mouthpiece from his transmitter and has substituted a non-perforated sheet of metal sufficiently thin at least at its middle to transmit the sound waves to the air cavity behind it. It is the inventor's idea to produce in this manner a more sanitary instrument than the one which is in common use.

A microphone invented by Mr. G. A. Nussbaum, of Lon-

don, England, is of very novel construction. The button is built up out of thin washers of carbon with a small aperture alternated with thin insulating washers with a large aperture, the central cavity thus formed being capped at either end by thin, unperforated disks. The insulating washers are too thin to admit carbon granules between the carbon plates. The plates therefore may be set in vibration, the air streams from between them serving to keep the granules from packing.

The standard tapered mouthpiece is departed from in the invention of Mr. Herman Foss, of Dombaas, Norway. He expands the mouthpiece midway of its length into a spherical resonance chamber in order to intensity the sounds.

Letter to the Editor.

THE ILLUMINATION OF TEXTILE MILLS.

To the Editor of Electrical World:

Sir:—Referring to the abstract in your issue of Dec. 16, 1911, page 1497, of the paper by Mr. Frank W. Reynolds on the illumination of textile mills, I may say that I have experienced the same difficulty which is there noted with respect to local lighting in a very large automatic screw-machine department crowded with apparatus requiring attention in much detail, the conditions being very similar to those existing in textile mills.

Local lighting close to the tool box is absolutely necessary, but by photometric observation it was found that at night it resulted, even with 16-cp units, in spot illumination

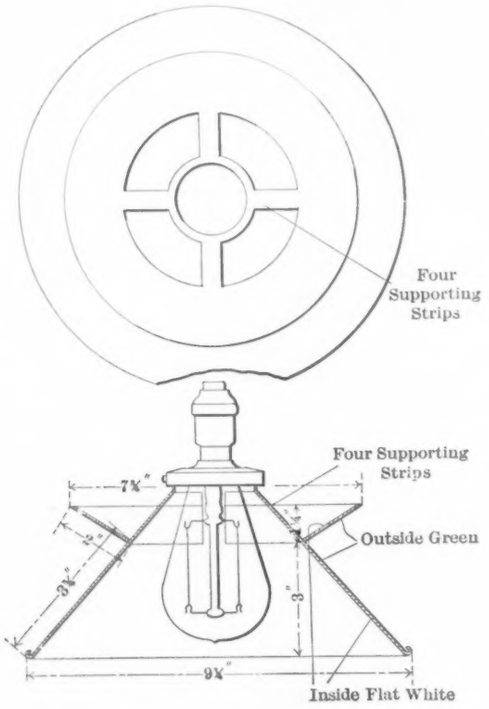


Fig. 1—Double-Coned Lamp Shade.

of a hard and disagreeable character, which sometimes exceeded considerably the intensity of daylight on the same part, while all around a dark zone prevailed.

Owing to the forest of belts and counters any general illumination was badly interfered with and proved unsatisfactory. I found a solution by devising a double-coned shade, as per inclosed sketch, which allowed sufficient light to fall on the toolbox and permitted the remainder to escape upward, whence, by reflection from white ceilings, it illuminated the area previously in shadow. The eye-strain of the attendant was noticeably relieved.

Ilion, N. Y. John Calder.

[In a paper entitled "The Mechanical Engineer and Prevention of Accidents," presented Feb. 14, 1911, before the

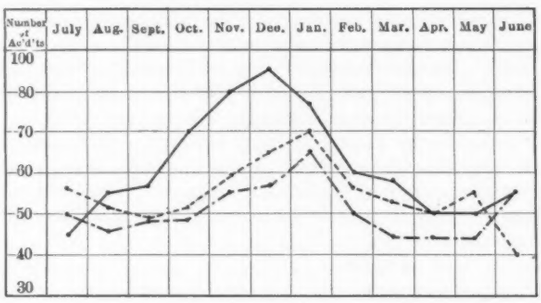


Fig. 2—Curve Showing Fatal Accidents During One Year.

American Society of Mechanical Engineers, Mr. Calder, who is manager of the Remington Typewriter Works, devoted a section to "Insufficient Lighting," which we reprint below, owing to its general relation to the subject under discussion:

"Insufficient lighting is a cause of numerous accidents, particularly serious and even fatal falls. The author has observed that a maximum of accidents occur toward the close and beginning of each year, that is, during November, December and January, the months of minimum daylight. Fig. 1 shows the seasonal distribution for three successive years of about 700 deaths annually from industrial accidents, which were reported with other injuries from an area embracing 80,000 plants of varying extents.

"The influence of the duration and intensity of natural light in working hours on fatal and serious accidents is particularly noticeable in founding, bridge-building, shipbuilding, engineering, steel and iron works and in other operations which have to be carried on within large spaces, often entirely in the open air and not easily illuminated artificially to the exclusion of deep shadows.

"Within plant buildings the intensity of artificial lighting at the cutting point of tools, for instance, and on very limited machine-tool or bench areas, is frequently far above actual requirements and a source of much physical discomfort, while all around the operative a semi-darkness prevails which has a blinding effect in the sudden transitions of the vision required by his employment.

"It has been found by exact photometric observations of shop-lighting conditions during both the day and the night that the concentrated illumination by means of shades of ordinary 16-cp incandescent units on cutting tools in machines and the area near them is often several times the intensity of ordinary daylight on the same parts. It is very difficult to convince the operative that he is suffering from too much light at any place and the call is constantly for more light.

"What is wanted from the safety point of view, and also, the author believes, from considerations of power economy, is the elimination by good illuminating engineering of this excessive hard light on spots only, which causes eye-strain and poor vision of surrounding areas with resulting accident. A more generally diffused light of less unit intensity is now easily obtained by the use of fewer but larger screened units experimentally located to suit varying shop requirements and reflecting from whitened wall and ceiling surfaces. The mechanical engineer administering industries or designing plants can do much to reduce the accident risk from this cause."]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Cast-Iron Magnets for Direct-Current Machines.—J. W. BURLEIGH.—The author describes a design of direct-current motors with commutating poles and an all cast-iron magnet system. Data of a special design of this kind are given, and it is thought that in general this method of construction lessens the machinery required, minimizes stock, increases the output of the work and reduces the prime cost. The efficiency is quite equal to that of steel construction, and the commutating properties are such that in a number of four-pole machines so far constructed it was found that, even with two consecutive rows of brushes lifted, at full load there was only very slight sparking, and in some instances none. In the machines thus far constructed the cast iron had been of quite an ordinary grade and worked at an apparent density of about 7800 lines per sq. cm. up to 12-hp output. It will probably be found in the larger sizes that even an apparent density of 10,000 lines may not be too high.—Lond. *Elec. Review,* Jan. 5.

Three-Phase Induction Machine.—T. F. WALL.—A paper read before the Birmingham Section of the (British) Institution of Electrical Engineers on the development of the circle diagram for the three-phase induction machine. The circle diagram is developed by considering the action of the rotating field on one phase. The power, torque and slip are represented by intercepts on certain straight lines. The accuracy of the diagram is discussed, and the results of tests on an 8-hp induction motor are compared with those deduced by means of the diagram.—Lond. *Electrician,* Jan. 5.

Diagrams.—G. RASCH.—The first part of an article referring to an older paper by Goerges, in which he gave diagrams for the mmf, the flux, the emf and the stray fluxes of windings for which the number of slots divided by the product of the number of poles and number of phases is a whole number, not a fraction. The present author now extends this investigation to windings in which the ratio just mentioned is not a whole number, but a fraction. The highly mathematical article is to be concluded.—*Elek. Zeit.,* Jan. 4.

Theory of Commutation.—K. PICHELMAYER.—An article on the calculation of the emf of self-induction which is produced in a coil short-circuited during commutation. The author has formerly given the formula for calculating this emf and shows now that it is correct in principle. He also describes a method of determining the one coefficient which occurs in this formula by sending an alternating current through the coil short-circuited by a brush.—*Elek. Zeit.,* Jan. 4.

Commutation of Single-Phase Commutator Motors.—CLAUDIUS SCHENFER.—An article illustrated by diagrams in which the author first develops the theory of the change in time of the current in the coils short-circuited during commutation in single-phase commutator motors. The general commutation equation is first given and a graphical solution of it is then found, whereupon the author gives oscillographic curves to confirm his theory.—*Elek. u. Masch.* (Vienna), Dec. 31.

Lamps and Lighting.

Condensers and Metallic-Filament Lamps.—W. PERREN MAYCOCK.—A further letter with reference to the system of Ashton recently described in the *Digest.* The author thinks that, though this system is more or less in embryo, yet it promises a really remarkable development in alternating-current lighting work. Thus far the method has been adopted in only one or two cases in street lighting and not at all in interior lighting, where it would have the larger scope. Low candle-power lamps are wanted in all kinds of interior shops, offices, factories, warehouses, etc. The following rules on the application of the system are given. The condensers must be suited to the circuit pressure and frequency and to the current required. The current in the condenser circuit must not vary; therefore there must either be a condenser to each lamp or, if more than one independently switched lamp is to be accommodated, the lamps must be put in series. Two or more lamps in parallel may be connected to a condenser, provided they are all to be put "on" or "off" together. The voltage of the lamp or lamps (in series) connected to the condenser is immaterial, so long as it does not exceed 40 per cent of the supply voltage. For example, if a condenser be connected to a 240-volt circuit, the one, two or more lamps in series with it may have different voltages, but the total must not exceed 96. The one, two or more lamps connected (in series) to a condenser must all take the same current, namely, that for which the condenser is built; or the condenser must be selected to suit the lamp current. Lamps in series must have their individual single-way switches so connected as to short-circuit them when they are to be extinguished. Single lamps or groups have their respective single-way switches connected in the ordinary manner. The condensers should be connected in the return side of the circuit. With a given supply pressure the cost of the condenser is the greater the greater the current. With a given current its cost decreases as the supply pressure and frequency increase. The series system would do well for very small buildings where the lamps are in separate rooms, though automatic short-circuiters might sometimes be necessary to deal with fractured filaments. For variable groups of lamps in one room it would be inconvenient to have short-circuiting switches in each lamp.—Lond. *Electrician,* Jan. 5.

Street Lighting.—H. F. J. THOMPSON.—An article on changing an old arc system of street lighting over to metallic-filament lamps, with special reference to the type of lantern to be selected and the construction of automatic switches by means of which certain lamps are turned off at a predetermined hour, say at midnight.—Lond. *Elec. Review,* Jan. 5.

Lamp-Testing Board.—H. R. TAUNTON.—An illustrated description of a simple and convenient testing board for testing eight different lamps, of two different sizes, connecting four in parallel, or four in series, or three in series, or two twos in series.—Lond. *Elec. Review,* Jan. 5.

Osmium Lamp Patent.—Among the British patents which will expire this year is one of Auer von Welsbach for the osmium lamp which is of historical interest as the forerunner of the present metallic-filament lamp. It describes methods of making osmium filaments, either by coating a platinum wire with osmium and finally driving off the platinum by heating electrically to a high temperature or by depositing osmium on a carbonaceous filament in an atmosphere of osmium vapor, the carbon being subsequently burned off.—Lond. *Electrician,* Jan. 5.

Generation, Transmission and Distribution.

Coal-Cutting Machinery.—W. BOLTON SHAW.—A paper read before the Manchester Association of Engineers. The author discusses the various types of coal-cutting machinery used at present and the advantages of electricity and compressed air for driving them. Figures of the relative power taken are also given.—Lond. *Electrician,* Dec. 22.

Traction.

Electric Traction in France.—J. Simey.—An account of the extended tests which are now being made with single-phase traction on a section of the Chemin de fer du Midi, which expects to electrify its lines in the Pyrenees Mountains. Experiments are made with six different locomotives made by six different French manufacturers. On three of the locomotives the compensated series motor is used, on a fourth the repulsion motor with a double set of brushes in short-circuit, and on the last two the compensated repulsion motor with two sets of brushes, one in short-circuit and the other in series with the primary. The equipment of the six locomotives is briefly described and illustrated.—*La Lumière Elec.*, Dec. 23.

Public-Service Applications of Electricity in Western Germany.—A. Haselmann.—The first of a series of articles on large-scale applications of electricity for public service in Rhineland and Westphalia, where the distribution of electrical energy has assumed a very large scope in view of the high density of population and the many industries located in that district. In the present instalment the traction systems in and around Aix-la-Chapelle are described. The total length is 201.9 km (120 miles), of which 54 km (32 miles) are within the city, 38 km (23 miles) are suburban lines, and 110 km (66 miles) are interurban lines. The financial results are quite satisfactory. The railway company of Aix-la-Chapelle has paid an average annual dividend of 6 per cent since the introduction of electric traction, and in the last years the dividend was 7 and 7.5 per cent.—*Elek. Zeit.*, Jan. 4.

Installations, Systems and Appliances.

Small Central Stations.—P. A. Spalding.—A paper read before the Dublin Section of the (British) Institution of Electrical Engineers. The author considers first the case of small areas having a population of from 1000 to 5000 and, secondly, small towns with from 5000 to 15,000 inhabitants. In both cases, as a rule, he advocates a two-wire supply at 220 volts and suction gas-engine or Diesel oil-engine plant. He finally refers to some interesting details of the small undertaking at Galway, and summarizes the results obtained in typical small concerns.—Lond. *Electrician*, Dec. 29.

Water Rheostat.—A fully illustrated description of a water rheostat for use in tests of large three-phase generators. In order to be available at any place where the test is to be made, the water rheostat is built so as to be portable. There are three wooden boxes filled with water and in each of the three boxes there are two pairs of electrodes. Each of the three phases of the system is connected to one electrode at one end of each box. The other three electrodes are connected together and form the neutral point. The load is varied by changing the distances between the two electrodes in each box and by changing the level of the water in the boxes.—*Elek. Zeit.*, Dec. 14.

Wires, Wiring and Conduits.

Testing High-Tension Cables in Water.—V. Planer.—In lead-armored cables there are sometimes faults in the lead. In order to detect them the usual practice in Germany is to place the cable for twenty-four hours in water and then test it. The present author has investigated whether this method is a really reliable test with modern cables. In several lead-armored cables insulated with impregnated paper a number of greater or smaller holes were artificially made in the lead armor and the cables were then placed in water. After every twelve hours the insulation resistance of the cable was measured and the cable was tested every hour at double normal voltage. After the cables had been in water for twenty-four hours or forty-eight hours the insulation resistance was just the same as before. The measurements were repeated daily and the results remained unchanged after five weeks. A second cable was placed in the water without a lead armor so that the impregnated paper was directly in contact with the water. After four weeks the cables could still withstand the test with double the normal voltage, while the insulation resistance had decreased by 10 per cent. These experiments prove that to place a modern cable for twenty-four hours in water before testing it is not a reliable method for detecting a fault in the lead armor. The best thing to do is to avoid these faults altogether, but for a control of the lead armor tests with compressed water should be employed, hydraulic pressures of several atmospheres being used for this purpose by some cable manufacturers.—*Elek. Zeit.*, Jan. 4.

Expansion Coefficient of Aluminum.—F. J. Brislee.—A paper in which the author gives 2.708 as the density of cast aluminum and 2.705 for hard-drawn rod. The coefficient of linear expansion was also measured and the formulas from which variations in length at any temperature can be calculated are as follows: Hard-drawn aluminum $L_t = L\ (1 - 0.00002432t)$; annealed aluminum $L_t = L\ (1 - 0.00002454t)$.—Lond. *Elec. Review*, Jan. 5.

Electrophysics and Magnetism.

Discharge Rays.—Elizabeth R. Laird.—An account of an experimental investigation of entladungsstrahlen (discharge rays) at atmospheric pressure and at diminished pressures. The experiments help to confirm the general theory of Sir J. J. Thomson concerning the spark discharge, and to show that the entladungsstrahlen are an electromagnetic radiation with properties approaching those of light, differing from light in lack of definite periodicity and becoming more penetrating at lower pressures. They show also that the ionization caused by this radiation is large in amount so that it must play quite a part in the passage of the discharge.—*Phys. Review*, December.

Positive Ionization from Hot Salts.—O. W. Richardson.—The author has formerly described experiments made to determine the value of the specific charge (e/m) of the positive thermions emitted by the salts of the alkali metals. The results of the experiments showed that the positive ions in each case were atoms of the basic metal carrying a single electronic charge. Since then the investigation has been extended in different directions. In giving the results he criticises some of the conclusions reached by other recent workers in this field. He emphasizes especially that all the direct evidence which appears to be trustworthy points to the view that the positive ions emitted by heated salts are metallic atoms. These are not necessarily atoms of the salts which appear to be under examination, but may be atoms of some other metal whose salts are present as an impurity, possibly in minute quantity only. On the whole, there is no reason for supposing that there is any essential difference between the mechanism of the large positive emission from freshly heated metals and that observed with salts.—*Phil. Mag.*, November.

Mobility of Positive Ions in Flames.—S. G. Lusby.—An account of measurements of the mobility of the positive ion due to salt vapors in a Bunsen flame at intervals of temperature ranging between 1150 deg. and 1950 deg. absolute. Down to 1300 deg. all salts of all conducting metals produce the same ion; below this temperature the ion due to monovalent metals has a greater mobility than that due to divalent metals. Between 1950 deg. and 1400 deg. the mobility varies as the square root of the temperature and corresponds closely to that calculated for a hydrogen atom. Below 1400 deg. the mobility drops very rapidly, as if extensive clustering took place.—*Phil. Mag.*, November.

Thermoelectricity and Magnetism.—L. O. Grondahl and S. Karrer.—An account of an experimental investigation of the thermoelectric behavior of Heusler alloys in a magnetic bath. The results show that the effect of the magnetic field on thermoelectric behavior is present in Heusler alloys and is of the same nature as in the case of

the magnetic metals. The surmise that the magnetic property of the alloys is different in nature from that of iron loses its support as far as the present phenomenon is concerned.—*Phys. Review,* December.

Radioactivity and Temperature.—H. CARTER.—There is at the present time no well-authenticated case where radioactivity is called into existence by any artificial process. All the known phenomena in this branch of science are due to the spontaneous atomic disintegration observed in the naturally active substances. If such an atomic disintegration can under any circumstances be set going artificially, it seems probable that this would occur in cases where large quantities of energy are being set free in a small volume. Such cases are those of the electric arc, the spark and the oxy-hydrogen and oxy-acetylene blowpipe flames. The author investigated these gases, searching for beta radiation which might be looked for at a convenient distance, but the results obtained are almost completely negative.—*Phil. Mag.,* November.

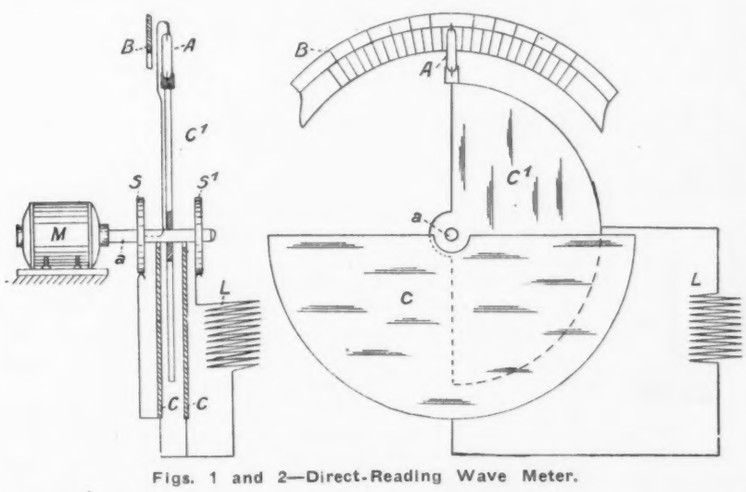
Electrochemistry and Batteries.

Efficiency of Storage Batteries.—W. HIBBERT.—The comparatively low watt-hour efficiency of a storage battery is essentially due to the fact that the average voltage during discharge is much lower than that during charge. This is essentially due to the concentration changes in the sulphuric acid. The efficiency may be raised by charging the plates of the battery in weak acid and discharging them in stronger acid. The efficiency may also be raised by heating because the higher temperature aids diffusion so that the concentration of the acid in the pores of the plates remains more nearly equal to that outside of the plates.—Lond. *Elec. Review,* Jan. 5.

Units, Measurements and Instruments.

Measurement of Dielectric Losses.—K. W. WAGNER.—An illustrated translation of his recent German paper on the measurement of dielectric losses by means of the Wheatstone bridge.—Lond. *Electrician,* Dec. 29.

Direct-Reading Wave-Meter.—E. F. HUTH.—A description of a new direct-reading wave-meter based on the resonance principle. The construction is shown in Figs. 1 and 2. *C* is a continuously adjustable condenser consisting of two half-circular disks, one of which is stationary while the other is revolved by an electric motor *M*. During each revolution the capacity therefore passes through a cycle from a maximum to a minimum, back to a maximum, etc. *L* is a self-induction which may also be adjustable, and *A* is a little glass tube filled with neon or helium. The tube *A* is connected in parallel with the capacity or self-inductance and is fixed to the revolving half-disk of the condenser so as to revolve with it. Whenever the resonance position is reached the neon tube lights up, giving the appearance of a light line. This happens once during each revolution, and during successive revolutions this always happens at the same place, so that the wave-length or the frequency may be read directly from the calibrated scale *B*. This wave-meter is not only far more convenient, but also more accurate than other wave-meters, and its power consumption is considerably less than that of wave-meters with hot-wire instruments.—*Phys. Zeit.,* Jan. 1.



Figs. 1 and 2—Direct-Reading Wave Meter.

Telegraphy, Telephony and Signals.

Interference Between Energy Transmission Lines and Telegraph and Telephone Lines.—K. HOHAGE.—The conclusion of his illustrated article. In the present instalment the author discusses first the protection of the apparatus and then methods of overcoming obnoxious noises in telephones due to induction effects or installation faults. The best method is to remove the trouble (the overtones) at the high-tension line as has been done in connection with the single-phase traction line between Sebach and Wettingham. In this case the overtones and the whole trouble disappeared after the commutator motors of the locomotives had been provided with closed slots.—*Elek. Zeit.,* Dec. 28.

Wireless Telegraphy.—P. SCHWARZHAUPT.—An article on the effect of sunlight and topography on wireless-telegraph transmission. Strong sunlight acts like a diminution of the insulation of the vertical wire and results in an increase of the damping and a reduction in the current in the vertical wire. The difference in the distance of transmission at different hours of the day is due to the absorption of electromagnetic waves, and in this phenomenon the ionization of the air seems to play an important part. A report is given of the results obtained between two stations on land over mountains and between two stations on shipboard and between shipboard and land as to the distance of transmission at day and at night hours.—*Elek. Zeit.,* Dec. 28.

Wireless Telegraphy.—W. H. ECCLES.—In the conclusion of his illustrated review of recent wireless telegraph patents the author deals with improvements made in receiving apparatus and in wireless telephony and also in antenna construction.—Lond. *Electrician,* Dec. 29.

Wireless Telegraphy.—K. LUBOWSKY.—An article on the use of wireless telegraphy in aeronautics with special reference to the best araringement of the antennas on balloons —*Elek. Zeit.,* Dec. 14.

Telephone Transfer.—An article on the recent transfer of the business of the National Telephone Company to the state in Great Britain. In general, all employees who were receiving a salary below a certain figure were taken over, but several of the principal engineers and superintendents have been omitted from the transfer.—Lond. *Electrician,* Jan. 5.

Cologne.—An article on the new telephone exchange of Cologne which was recently opened, replacing the old system which had been in use for eleven years. The city telephone system comprises two groups each for 10,000 subscribers. The toll system comprises 700 lines.—*Elek. Zeit.,* Jan. 4.

Miscellaneous.

Lightning Conductors.—A TURPAIN.—An article giving the results obtained in a country estate in France with a number of pure-copper lightning conductors for protection against thunderstorms. The author emphasizes that to be efficient the conductors should have a large surface and should be as straight as possible from top down to the earth connection. Such copper lightning conductors should be provided at not too great distances, say, 660 ft.—*La Revue Elec.,* Dec. 8.

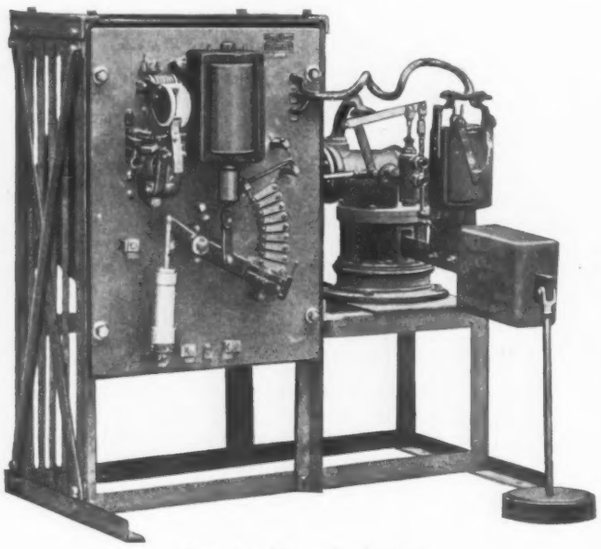
New Apparatus and Appliances

MORE INCANDESCENT LAMPS STANDARDIZED.

Several new sizes of incandescent lamps are announced as additions to standard lines. Regular Mazda lamps for 100-130 volts are now to be had in the 15-watt and 20-watt sizes in straight-sided bulbs and 15-watt sizes in 2⅝-in. round bulbs. For voltages between 200 and 260 a 25-watt regular Mazda lamp is now available. A complete line of Gem and Mazda lamps for street-railway service has just been brought out. This includes 35-watt and 54-watt Gem lamps for burning five in series on 500 volts to 650 volts. For gage-light service Mazda lamps of the sign type are now made in 2½-watt, 3½-watt and 5-watt sizes so selected for current as to operate in series with regular car lamps. The use of regular Mazda lamps in street cars has been proved entirely practicable by numerous service tests under various conditions. Most of the above lamps are derived from regular multiple lamps by operating them at reduced efficiency and power consumption. To the train-lighting list has been added a 10-watt Mazda lamp which has already been used to a large extent as a berth lamp. Among the regular Gem lamps is now listed the 30-watt size in a 2½-in. bulb. These will supply the demand for small incandescent lamps of about 8 cp or 10 cp or replace the similar carbon lamp.

PUMPING MOTOR CONTROLLER.

An interesting application of pump control was recently made by the Rochester Railway & Light Company in the case of a customer who was using a motor to drive a rotary screw pump delivering water to a pressure tank operating a hydraulic elevator. The operation of this outfit was noisy. It failed to maintain sufficient pressure during the rush hours of the day, and, being of low efficiency, caused a high consumption of electrical energy. The problem was similar to two others that had been previously solved by the engineers of the same company.



Pumping Motor Controller.

A triplex pump in this case was substituted delivering 200 gal. per minute and was driven by a 13-hp, 220-volt variable-speed motor. The controller, furnished by the Cutler-Hammer Manufacturing Company, of Milwaukee, and illustrated herewith, regulates the motor automatically so that when the elevator service is light the pump is run at its lowest speed, while as service grows heavier the motor speed is increased automatically by the controller and more water is pumped to meet the demand.

It is stated that the customer is saving $600 per year, which is 40 per cent of the cost of the new controller, pump and motor. The power rate is better because the controller maintains a fairly uniform tank pressure and sudden and high current demands do not occur. The controller used in this case is of different construction from the standard line, having the regulating resistance mounted on the back and the automatic starter on the front of the panel, making it very compact.

PETTINGELL-ANDREWS SALESMEN'S WEEK.

The first week of January was the occasion of the inauguration by the Pettingell-Andrews Company's organization, of Boston, of a salesmen's week. All the company's salesmen were called in from the road and during the week listened to prepared addresses, many of them illustrated by lantern slides, given by special representatives of various prominent manufacturers. All told there were six morning, five afternoon and two evening sessions, or thirteen in all, at which twenty-two addresses were delivered. As this constituted a rather serious program, necessary provision was made for relaxation. On Friday evening, Jan. 5, the officers of the company gave a dinner to the salesmen, special features of which were favors of tiny salesmen's grips, special topical songs, limerick jests on important men in the company, and two-minute addresses by salesmen and officers. The genial salesman Mr. Peterson was toastmaster at this dinner and the program was planned and handled by the advertising manager, Mr. Carroll Westall. The names of the entries of the menu were extended by electrical additions, such as "National Code cheese—bare and insulated." The success of the first salesmen's week and dinner was so gratifying that the event will probably be made an annual one by the Pettingell-Andrews Company.

COMPARISON OF SINGLE-PHASE AND POLYPHASE SYSTEMS.

Before the Wisconsin Electrical Association, at Milwaukee, Jan. 18, Mr. F. N. Jewett, of the Wagner Electric Manufacturing Company, St. Louis, Mo., presented a discussion of the relative merits of the single-phase and the polyphase method of distribution of energy. In comparing the cost of transformers he pointed out that one single-phase transformer costs less than either two or three single-phase transformers of equivalent capacity. For example: Three 5-kw transformers, $135 each, list $405; one 15-kw transformer lists $300; saving $105, or 26 per cent. Two 7½-kw transformers, $178 each, list $356; one 15-kw transformer lists $300; saving $56, or 15.7 per cent. Comparing single-phase and three-phase transformers: One 15-kw three-phase transformer lists $380; one 15-kw single-phase transformer lists $300; saving $80, or 21 per cent.

These figures do not take into consideration the increased cost of installation, the increased cost of labor for connecting, nor the running of additional feed wires if the customer is not located near the main polyphase feeders.

Transformer losses are from 15 to 35 per cent less with single-phase-motor installations than with polyphase. It will be generally admitted that the losses of a three-phase transformer are not greater and usually are less than the losses of an equivalent arrangement of two or three single-phase transformers. Comparing one single-phase transformer with an equivalent three-phase transformer, it is found that the saving on the single-phase installation actually runs from 20 to 30 per cent. This is particularly noteworthy at this time when purchasers of transformers are laying so much stress on very slight savings in core and copper losses.

These percentages of saving in first cost and in losses are greater in the smaller sizes than in the larger sizes, illustrating why some progressive companies refuse to furnish polyphase energy for any installation smaller than 7½ hp even though their three-phase lines pass the customer's premises.

Meter investment is from 10 to 50 per cent less for single-phase than for polyphase motors. While for a given horsepower of installation the ampere capacity of the single-phase meter is greater than that of the polyphase meter, the first cost of the latter averages 26 per cent greater than the single-phase meter for equivalent rating.

Central-station operators generally recognize that single-phase meters are more accurate and reliable than polyphase meters, besides being simple to connect and install. The average lineman cannot be trusted to connect a polyphase watt-hour meter properly. Hence high-grade and expensive men must be used for installing and inspecting. For this reason two or more single-phase meters are often used, although entailing an even more marked difference in first cost.

That single-phase distribution is cheaper than polyphase, in both labor cost and expense of conductors, conduit, cross-arm space, pins, insulators, etc., seems to need little discussion here. Single-phase requires two wires; polyphase requires at least three wires, and often four.

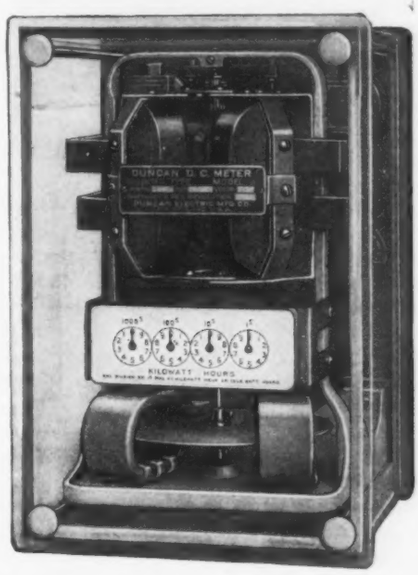
There is a general impression among central-station men that single-phase motors create more line disturbance during starting than do polyphase motors, although, according to Mr. Jewett, the actual facts demonstrate the reverse. For example, Wagner single-phase motors used without starters require from 2.50 to 2.75 times full-load current at starting. Squirrel-cage polyphase motors without starters take from six to nine times full-load current. In small sizes, 5 hp and less, where starters are not required with either single-phase or polyphase motors, these facts should be of interest. If at full load a certain single-phase motor requires 30 amp. the corresponding three-phase motor would take 15 amp per phase. In starting, the single-phase motor would draw 75 amp from one phase while the other two phases would be disturbed only to the extent of 37.5 amp. The polyphase motor would draw 90 amp from each phase. All lamps on the three phases would thus be disturbed more by the starting of the polyphase motor than would the lighting on one of the phases by the single-phase motor.

Repulsion motors show comparatively high power-factors at starting, whereas induction motors are particularly low in power-factor at starting. The Wagner motor already mentioned starts like the repulsion type and automatically changes to induction on attaining nearly full-load speed.

The full-load current of the new Wagner unity-power-factor motor is considerably less than the full-load current of the older motor because of its unity-power-factor operation. The starting current in amperes drawn from the line with the new motor is less than with the older motor and of a better power-factor. Because the new unity-power-factor motor requires less starting current and requires so much less current at full load its use makes a still further saving in transformers, meters, secondary and primary distribution circuits, and even in generating capacity, compared with requirements of any other type.

ASTATIC, SHUNTED-TYPE, DIRECT-CURRENT WATT-HOUR METER.

The Duncan Electric Manufacturing Company, Lafayette, Ind., has brought out an astatic, shunted-type, direct-current watt-hour meter for switchboard service which is characterized by the following make-up: Gold commutator, cupped diamond lower bearing, multipoint compensated switch for light-load adjustment, artificially aged permanent magnets, non-warping aluminum retarding disk, eight-pole field coils, eight-pole armature, heavy cast-aluminum back support and all-plate-glass cover. The meter is stated to have a driving torque of approximately 180 milligrams, and its motor element is so constituted that there are no stray lines of force emanating from its series field coils and armature to affect the retarding magnets or to call for



Astatic, Shunted-Type, Direct-Current Watt-Hour Meter.

the employment of magnetic shields. The meter is said to respond at all times to any load, however small, and to give a speed which is at all times proportional to the actual power consumed. Although of the commutator type, the element of friction is said to be insignificant owing to the high torque possessed by the instrument, which is also, it is claimed, immune from inaccuracies caused by changes in temperature. The absence of a magnetic shield is held to be an advantage, since this oftentimes becomes polarized and destroys the original calibration of the meter, which must be tested at frequent intervals as a consequence or have its shield removed and demagnetized. The meter is said to be as reliable and as accurate in service as the usual series type commonly employed on switchboards.

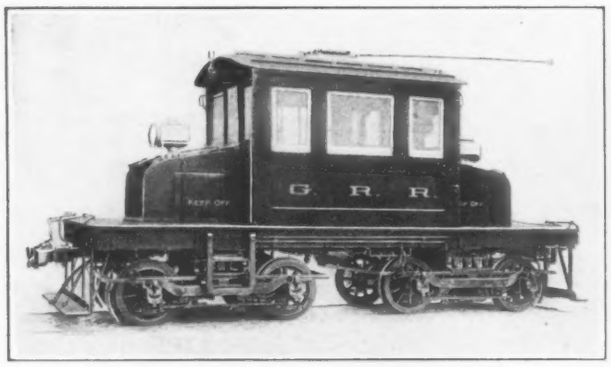
27-TON LOCOMOTIVE FOR THE GUELPH RADIAL RAILWAY COMPANY.

The Guelph Radial Railway, Guelph, Ont., has recently purchased a 27-ton Baldwin-Westinghouse direct-current locomotive, shown in the accompanying illustration. The cab, trucks and all mechanical parts were built by the Baldwin Locomotive Works, and the electrical equipment, including motor and control, was furnished by the Canadian Westinghouse Company, Limited, of Hamilton, Ont., after the design of the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa.

Interurban and city railways are using locomotives like

this one and larger for freight, switching and various kinds of service. A road's earning capacity can, for example, be materially increased by using locomotives to haul freight during the night or idle hours, thus improving the load factor. Many city roads also use similar locomotives for hauling construction material and refuse to dumping grounds.

The Guelph locomotive is ruggedly built. The frame is



27-Ton Electric Locomotive.

of channel-iron construction, and the cab is substantially built of clear ash fitted together with joint bolts and corner plates. The trucks are of the standard Baldwin electric equalizer-bar type with chilled cast-iron wheels. The electrical equipment consists of four 40-hp, 500-volt Westinghouse railway motors and necessary control. It is also equipped with Westinghouse automatic and straight-air brakes with outside equalizing driver brakes. The principal dimensions are as follows: Length over end sills, 23 ft.; width over all, 8 ft.; truck centers, 12 ft.; rigid wheelbase, 6 ft.; total wheelbase, 18 ft.; wheel diameter, 33 in.

The hauling capacity with cars weighing 45 tons, with loads at 10.75 miles per hour at 500 volts, is: On a straight, level road, seventeen cars; on a one-half of 1 per cent grade, seven cars; on a 1 per cent grade, four cars; on a 2 per cent grade, two cars.

The figures for a straight, level road show the load which may be handled in switching service. The grade values given are safe when the grade requires a pull of but five or ten minutes' duration. In any particular case the number of cars that can be handled may be greater or less than the figures given, depending upon the profile, curves and operating conditions.

ELECTRIC OMNIBUSES FOR PASSENGER SERVICE BETWEEN DEPARTMENT STORE AND RAILROAD STATIONS.

The Electric Omnibus Corporation, New York City, has shipped to Chicago four Field electric omnibuses equipped with Edison storage batteries for Carson, Pirie, Scott & Company. These omnibuses are to run between the large department store of Carson, Pirie, Scott & Company and the railroad stations on a regular schedule, for the convenience of the customers of the store. The seating capacity is for eighteen passengers, entrance being in front, where the fare is deposited in a fare box close to the bus operator.

The omnibuses have been very thoroughly tested on the streets of Troy, N. Y., and are said to have shown economical results in watt-hours per ton-mile. They are geared for a speed of 12 miles maximum per hour, and with the aid of the necessary boosting charges during the day can perform a full day's service of about 80 miles total run. Each bus has a 60-volt series-wound General Electric motor with direct drive through universal joint to a jack-shaft from which the power is transmitted by a chain to the rear wheels. The controller, located close to the motor, has six speeds forward and three reverse and is operated by a lever attached to the steering-wheel column. The batteries are placed under the seats and in the bonnet in front, where

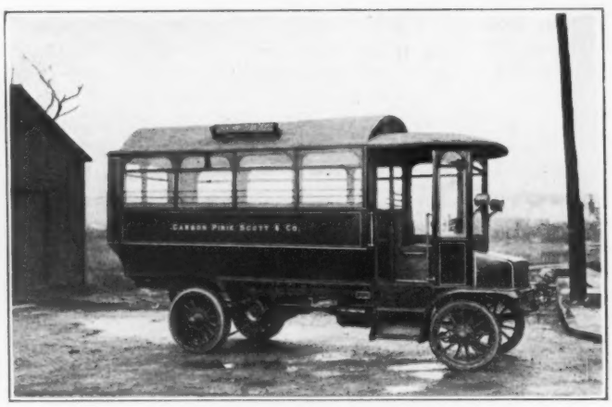


Fig. 1—Electric Omnibus.

they are readily accessible for examination and attention. There are two independent brake systems with four brakes. The rear wheels are 34 in. in diameter, equipped with dual 3½-in. rubber tires, and the front wheels are 32 in. in diameter with single 3½-in. solid-rubber tires. Tests have shown that at least 69½ per cent of the battery output is delivered in power to the rear wheels.

Fig. 2 shows the running gear of the car. The power transmission is simple and effective and the bus is thoroughly under the control of the operator at all times. This company is building buses for regular city service having a seating capacity of thirty to thirty-four passengers. This size bus has also a rear entrance and has a conductor in addition to the operator. The company is also building twelve-passenger hotel buses.

One of the important developments in the omnibus method

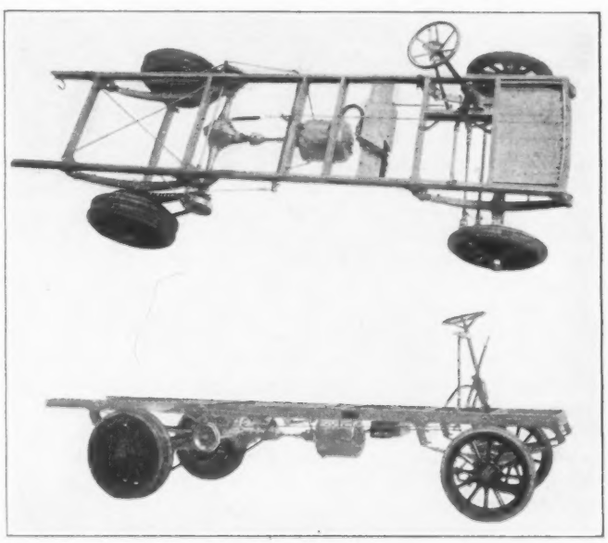


Fig. 2—Design of Electric Omnibus

of transportation will be along streets where car tracks would not be permitted, and therefore this development is of interest to the general public and to investors who would receive large results from money invested in omnibus lines. This return would come quickly because no large amount would be invested in unproductive construction work.

Industrial and Commercial News

TRADE conditions this week were marked by the conservative attitude which dominated business in 1911. Business, as a whole, was irregular during the week and no changes of importance were noted in any of the industries other than iron and steel. A slight curtailment was reported in the amount of new business being placed with the steel companies, and the pig-iron market was quieter than it has been in recent weeks. Prices of wire and wire products were advanced $1 per ton in the early part of the week. In the majority of lines orders were placed only for small amounts. There was no pronounced movement in the New York stock market, and prices did not differ greatly from those of the preceding week. A fair demand for bonds developed in the middle of the week, due to a desire for temporary investment of the abundance of funds lying idle on account of the quietness in general trade. Rates in the money market Jan. 24 were: Call, 2@2¼ per cent; ninety days, 2¾@3 per cent.

THE COPPER MARKET.

Extreme dullness prevailed in the copper market all through this week, and although prices were lowered to a slight extent, few sales of importance were made. The decided lack of response to offerings of electrolytic at 4¼ cents per pound indicated very plainly that consumers are well supplied for present needs. Prices abroad showed an upward tendency. In the early part of the week electrolytic was quoted abroad at 14 cents per pound, but buying was light since foreign consumers are now supplied on contracts placed a short time ago when prices were lower. These conditions in the foreign market have brought about a mild curtailment in the export rate, as compared with that in recent weeks, but in spite of this shipments continue on a fairly liberal basis. Since the first of the month, including Jan. 24, exports have amounted to 18,848 tons. There seems to be little prospect of heavy buying in the New York market until demand for the metal is broadened as a result of improvement in general trade throughout the country. Copper was quoted on the New York Metal Exchange Jan. 24, as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	13.90	14.12½	.....
January	13.90	14.12½	14.00
February	13.95	14.02½	14.00
March	13.92½	14.12½	14.00
April	13.92½	14.12½	14.00
May	13.92½	14.12½	14.00

The London market, Jan. 24, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	62 3 9	62 18 9
Standard copper, futures	62 8 9	63 3 9

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	14.12½c	13.87½c
London, spot	£64 5 0	£61 17 6
London, futures	65 0 0	62 11 3
Best selected	68 5 0	66 10 0

INDUSTRIAL AND COMMERCIAL NOTES.

Annual Report of Siemens-Schuckert Works.—The annual report of the Siemens-Schuckert Works shows that the combination has during the year not only issued bonds to the amount of $7,500,000 but has also taken a loan from its two component companies at 6½ per cent. The total loan is $7,500,000, and the Siemens & Halske Company has procured its share of $3,750,000 by selling government bonds, the Schuckert Company having issued for the same purpose new stock to the amount of $2,500,000. The latter is entitled to one-half dividend for the present year. The business expansion of the company is indicated by the fact that the total sum of the balance sheet of the combination has increased from $17,000,000 to $60,000,000, and that the number of workingmen and officials has increased from 14,000 to more than 66,000 since the combination. All of the plants have been so busy, despite their enlargement, that night shifts have had to be inaugurated, and the peak of the load does not seem to have been reached yet, since the orders in the first months of the business year showed a considerable increase over last year. The company manufactured 95,116 motors and transformers, aggregating 2,646,327 hp, as against 66,227 last year, aggregating 2,100,879 hp. Motors with ratings as high as 16,000 hp have been built for reversing rolling mills, and generators as large as 21,500 kva for power-plant work. The Siemens & Halske Company has entered into an exchange of patents and experience in metallic-filament lamp manufacture with the General Electric Company of this country. It has also arranged a mutual exchange of patent rights with the Allgemeine Electricitäts Gesellschaft and with the German Welsbach Company. During the past year the selling price of incandescent lamps was greatly reduced. The report is not very enthusiastic concerning the financial situation, especially as regards prices. While there were many orders, it was not possible to maintain the level of prices of last year. In the report of the Siemens & Halske Company it is stated that there were price reductions in certain cases, but these were offset in a measure by increased output and more profitable developments in other fields. The company has had a most successful year in its telephone, telegraph and railway-signal department, and the report emphasizes especially large orders in automatic telephone exchanges, Pupin coils, submarine telephone cables, wireless telegraph apparatus, ozone generators for water purification and the "Wotan" (ductile tungsten) lamps. The Siemens & Halske Company has declared a dividend of 12 per cent, and the Schuckert Company declared a dividend of 7½ per cent, while the Siemens-Schuckert Works paid a dividend of 10 per cent.

American Boiler Manufacturers' Association.—President E. B. Mier of the American Boiler Manufacturers' Association has authorized the secretary of the Supplymen's Association of the A. B. M. A., F. B. Slocum, Continental Iron Works, Brooklyn, to issue an open letter to boiler, tank and stack manufacturers of the United States and Canada urging them to attend the coming meeting of the body in New Orleans, March 12-15, at which time an effort will be made to fix uniform specifications. The letter states that the first action of the organization in 1889 was to establish the specifications for boiler steel and construction which have become the standard by the general concurrence of manufacturers and engineers. In 1907 Massachusetts adopted a code of boiler rules in general consonance with these specifications. This code has been adopted by several states since and is likely to be very generally enacted throughout the country. It is important therefore that any imperfections or crudities in these rules should be frankly criticised by practical boiler manufacturers, with a view to perfecting the code and eliminating the effects of unjust or ill-considered legislation.

Garwood Reorganization Progressing Satisfactorily.—Interests in close touch with the affairs of the Garwood Electric Company, of Garwood, N. J., which went into a receivership last October, as noted in these columns Oct. 14, 1911, state that the affairs of the company are now proceeding very smoothly, and that, as soon as ample working capital for some little time to come is assured, the receivership will be terminated. October business of the company was under normal, as an outcome of the receivership, but since November orders have been received in better volume. December business was up to normal. Orders recently placed with the company include motors for ventilating equipment for the following: The fifty-five-story Woolworth Building, now in course of construction at Broadway and Park Place, New York City; the new New York Post Office; the Scottish Rite Temple, Washington; the Central Railroad of New Jersey, Jersey City, N. J., and the new building of the National Cash Register Company, at Dayton, Ohio.

Stone & Webster Texas Construction Work.—The Stone & Webster Engineering Corporation, of Boston, Mass., has a large amount of work under way in Texas at this time. It is putting the finishing touches on the new line of the Galveston-Houston Interurban Electric Railway Company that runs between Galveston and Houston, 51 miles, and is preparing to make important improvements to its recently acquired electrical properties in Beaumont. In north Texas it is constructing the line of the Dallas Southern Traction Company between Dallas and Waxahachie and the line of the Forth Worth Southern Traction Company between Fort Worth and Cleburne. It is also increasing the capacity of the plant of the Dallas Electric Corporation at Dallas and will install additional equipment at the electric power station at Handley. H. M. Osgood, one of the company's engineers, is in Dallas making investigation with a view to placing the wires of the Dallas Electric Corporation under ground in the business district. The improvements to the latter's property will cost about $300,000, and among other things will consist of a 5000-kw turbine generator and the erection of a new building. New boilers and engines will also be installed. To the equipment of the power station at Handley there will be added a turbine generator of 4500-kw capacity and other machinery. The company is also making improvements to its property in El Paso, having just finished installing at its power plant there a turbine generator of 2000 kw. The City Commission of Dallas recently accepted the bid of the Dallas Electric Corporation to furnish street arc lights at $56 per lamp per annum, which is a reduction of $4 per lamp from the old contract. The new contract is for a period of three years. There are about 1000 lamps to be served.

Huge Canadian Power Project.—Advices from Montreal state that the Eastern Canada Power Company, which was incorporated last November with a capital of $1,000,000, is planning to increase its capital to $100,000,000 and to erect a plant with a capacity of nearly 1,000,000 hp on the St. Lawrence River. It is said that Sir Max Aitken heads the syndicate promoting this venture, and that his associates are: H. S. Holt, president of the Montreal Light, Heat & Power Company; James Redmond, director of the Royal Bank of Canada; D. Lorne McGibbon, together with other British and American capitalists. The syndicate plans to divert the St. Lawrence at Coteau and Cedar Rapids, above Montreal, and change the waterway so as to run about a half mile from its present course. Application has been made to the Dominion government for permission to make this change.

New York State Independents Consolidate with New York Telephone Company.—Formal steps were taken at the annual meeting of the Mountain Home Telephone Company, of Saranac Lake, N. Y., Jan. 19, to effect a merger of the independent telephone systems in Clinton, Franklin, St. Lawrence and Essex Counties, of New York State, with the New York Telephone Company. The value of the properties involved is more than $2,250,000, and there are approximately 12,000 telephones in service in the district, with about 900 miles of toll lines. This move will end telephone competition in the section and will also reduce plant duplication to a great extent.

Another Unit for McCall Ferry Plant.—The Pennsylvania Water & Power Company, of McCall Ferry, Pa., has placed an order with the Westinghouse Electric & Manufacturing Company for one 12,000-kva, 11,000-volt, three-phase, 25-cycle, 116-r.p.m. vertical waterwheel generator. This is one of the largest machines of this type that have ever been built and will be used to supplement the existing power-plant equipment at McCall Ferry, from which the Pennsylvania company sends energy to Baltimore, Md.

Federal Light & Traction Company to Develop Missouri Power Site.—The Federal Light & Traction Company, 60 Broadway, N. Y., has closed a contract with the Ozark Water & Power Company, of Springfield, Mo., for building a dam and hydroelectric plant on the White River in the Ozark district of Missouri. About $500,000 will be expended upon the plant, which will furnish energy to Springfield and other cities in southern Missouri about Nov. 1, 1912.

A New Pittsburgh Lighting Company.—The Keystone Lighting Company has received a franchise giving it the right to furnish electricity for light and power purposes in Pittsburgh, Pa. The city has an option to purchase the plant of the company after twenty-five years, at cost plus 25 per cent.

Isthmian Canal Proposals.—Circular No. 677 of the Isthmian Canal Commission, Washington, D. C., contains invitations for proposals on 1500 lamp sockets, 1225 fuses, 18 potheads, 85 electric switches, 72 pairs of rubber gloves, 42,000 ft. of rubber-covered wire and 300 lb. of magnet wire. Proposals will be received until 10.30 a.m. Feb. 3, 1912.

Financial.

Puget Sound Traction Merger Declared Operative.—Stone & Webster announce that the Puget Sound Traction, Light & Power Company, a merger of several Stone & Webster interests on the Pacific Coast, referred to in these columns Jan. 13, has been organized under the laws of the State of Maine. Sufficient assents to the plan of consolidation having been received, it has been declared operative. Notices are being sent to stockholders of the Seattle Electric Company, Pacific Coast Power Company, Puget Sound Electric Railway and the Whatcom County Railway & Light Company, requesting that stock certificates be deposited with Stone & Webster, transfer agents, Boston, for exchange for stock of the new company.

Westinghouse Machine Company Will Increase Capital.—A meeting of the stockholders of the Westinghouse Machine Company will be held at the offices of the company, East Pittsburgh, Pa., on March 29, for the purpose of voting upon a proposed increase of the capital stock and to act upon a proposal to issue the whole or a portion of this additional capital stock as preferred stock, with such modifications and features as may be designated by the stockholders. The amount of the proposed increase will be made known later. Another meeting is to be held on the same day to vote upon a proposed increase of the indebtedness of the company.

Consolidated Gas May Buy Queens County (N. Y.) Utilities.—Application has been made to the Public Service Commission for the First New York District by the Consolidated Gas Company, of New York, for permission to acquire a controlling interest in the New York & Queens Electric Light & Power Company and the New York & Queens Gas Company. If this application is granted, the Consolidated company will control all the gas and electric lighting companies furnishing service in Long Island City, Astoria, Jamaica and Flushing, New York. A hearing has been scheduled by the commission for Jan. 31.

Great Falls Power Company's Bonds.—The Bankers' Trust Company, of New York, as trustee under the first mortgage of the Great Falls Power Company, of Great Falls, Mont., dated May 1, 1911, has given notice that it will receive sealed proposals at its office, 7 Wall Street, New York, up to the close of business Feb. 12, 1912, for sale to it at not to exceed 107½ per cent and accrued interest, of sufficient bonds secured by this mortgage to exhaust as nearly as practicable the sum of $50,000, the present amount of the sinking fund.

Electric Bond & Share Increase Ratified.—Stockholders of the Electric Bond & Share Company, 71 Broadway, New York, at a meeting Jan. 22 approved the proposition, mentioned in these columns Jan. 13, to authorize an increase in capital stock from $4,000,000 to $10,000,000, to consist of $5,000,000 preferred and $5,000,000 common stock, together with an increase of the preferred-stock dividend rate from a 5 per cent cumulative to a 6 per cent cumulative basis per annum.

Mexico (Mo.) Power Company.—Chicago bankers are offering the unsold portion of an issue of first-mortgage 6 per cent gold bonds made by the Mexico Power Company, of Mexico, Mo. These bonds are part of an authorized issue of $300,000, of which $185,000 is outstanding. The bonds mature serially between 1913 and 1920. The company furnishes electrical energy, gas, water and central-station steam heating to Mexico, Mo., and electrical energy to Centralia, Mo.

Philadelphia Electric Company Merger Revived.—The assumption of the control of the Philadelphia Electric Company by the United Gas Improvement Company, which has been predicted persistently during the past two years, now appears to be assuming definite shape, although no official announcement has as yet been made. The Philadelphia Electric Company has 1,000,000 shares of capital stock outstanding, of a par value of $25, but only $15 per share has been paid in. Dividends are being paid at the rate of 6 per cent per annum. Lately it has been generally admitted, but not officially announced, that a further assessment of $2.50 a share would be called on the stock this spring, yet in spite of this fact there has been steady buying of the shares, with the price holding close to $18 a share, the highest ever reached.

Mobile Electric Company.—Seven per cent cumulative preferred stock of the Mobile (Ala.) Electric Company is being offered at a price to yield 7.375 per cent. In a circular it is stated that the net earnings for the year ended July 31, 1911, were $159,379; bond interest, $78,900, leaving a surplus of $80,479, from which $37,069 was paid in dividends with a balance of $43,410. A majority of the stock of the Mobile Electric Company is owned by the Standard Gas & Electric Company, which is under the management of H. M. Byllesby & Company. The Mobile company owns a modern power house with a rating of 4050 kw in electrical output. The total number of customers on July 31, 1911, was 5798, and the total connected load 10,159 kw. Electricity was supplied to 104,603 standard 16-cp incandescent lamps and 511 motors, the latter having a rating of 4115 hp.

Chicago & Milwaukee Electric Railroad Reorganization.—It is reported that the bondholders of the Chicago & Milwaukee Electric Railroad Company have agreed upon a basis of settlement for the reorganization of the company. The new committee of reorganization includes George M. Reynolds, Ernest A. Hamill, W. E. Stavert, George A. Somerville, Miller Lash, Robert Cassels, R. F. Clinch, E. A. Shedd, John R. Thompson and H. S. Osler. Chicago, Wisconsin and Canadian bondholders are represented on the committee. The proposition to give the Chicago & Milwaukee a downtown terminal in Chicago over the Northwestern elevated tracks has been revived.

Western Union to Redeem 4 Per Cent Convertibles May 1.—Notice has been sent by the Western Union Telegraph Company to holders of its $8,000,000 convertible 4 per cent bonds, due in 1936, that it will exercise its option to redeem these on May 1, at 105. The bonds were issued in 1907 and were secured by 97,331 shares of New York Telephone Company stock. These shares were included in a block of $16,000,000 New York Telephone stock sold in 1909 by the Western Union to the American Telephone & Telegraph Company. The latter will receive the collateral after its release, May 1.

Pacific Gas & Electric Will Redeem Bonds.—Notice is being given by the Pacific Gas & Electric Company, which operates under the laws of California, that on Feb. 9, 1912, it will redeem at 105 per cent of their face value and accrued interest the entire issue of its general-mortgage and collateral-trust 5 per cent thirty-year gold bonds, which were secured by its general and collateral-trust mortgage dated Jan. 2, 1906, made to the Union Trust Company of San Francisco, trustee.

Michigan Traction Sold.—The United Light & Railways Company, of Maine, which controls and operates a number of light and traction properties in Michigan, Iowa, Tennessee and Indiana, has purchased the entire stock issue of the Grand Rapids, Grand Haven & Muskegon Railway Company, of Grand Rapids, Mich., amounting to $1,200,000. The bonded debt of the traction company is $1,500,000 at 5 per cent.

Germany Buys South American Cable Lines.—It is announced that controlling interest in the Compañia Telephonica y Telegraphica del Rio de la Plata, a South American cable company, has been purchased by the German government. The report states that this transaction indicates prolongation of the German-South American cable from Pernambuco to Buenos Aires.

Cities Service Company Increases Common Dividend.—A monthly dividend of one-third of 1 per cent has been declared on the common stock of the Cities Service Company, which places the issue on a basis of 4 per cent per annum, an increase of 1 per cent.

MARKET PRICES.

	Jan. 17.	Jan. 24.		Jan. 17.	Jan. 24.
Allis-Chalmers	1*	1¼	General Electric.....	159¾	160
Allis-Chalmers, pf....	8*	6⅛*	Mackay Companies..	78	75¾
Amalgamated Cop.....	65⅛	64⅜	Mackay Cos., pf.....	69*	70½
Boston Edison.....296*		297	Philadelphia Elec....	17⅝	17⅝
C'monwealth Edison..138		138½	Western Union.....	84¾	83½
Elec. Storage Bty...	53¼*	55	Westinghouse	73¼	74
Elec. Stor. Bty., pf.	30*	30*	Westinghouse, pf....	118*	119¼*

*Last price quoted.

Personal.

Dr. Herbert E. Ives, of the Physical Research Department of the National Electric Lamp Association, read a paper on "Light and Light Sources" before the Cleveland branch on Jan. 20. The paper was illustrated with numerous lantern slides.

Mr. H. L. Cooper, vice-president and chief engineer of the Mississippi River Power Company, gave an illustrated lecture before the Illinois Society of Engineers and Surveyors at Urbana, Ill., on Jan. 19. His subject was "The Keokuk Water-Power Plant."

Mr. Evan J. Edwards, of the engineering department of the National Electric Lamp Association, read a paper before the Detroit Engineering Society, Detroit, Mich., on Friday, Jan. 19, dealing with the latest developments in the manufacture of incandescent lamps.

Mr. F. Douglas Watson, late provincial superintendent for the National Telephone Company in Scotland, has been appointed general manager and secretary of the Société Anonyme Ottomane des Téléphones de Constantinople (Constantinople Telephone Company).

Mr. D. G. Wallace has been made operating engineer of the Bloomington & Normal Railway & Light Company, Bloomington, Ill., For the past two years Mr. Wallace was superintendent of the power plant of the company, and his present post has been just created.

Mr. Albion E. Lang, formerly president of the Toledo Railways & Light Company, Toledo, Ohio, sailed on the S. S. *Blücher* from New York Saturday for an extended pleasure trip in southern waters. Mr. Lang will visit Rio de Janeiro, Buenos Aires, Valparaiso and a number of other cities in South America.

Mr. H. M. Byllesby, of Chicago, addressed a joint meeting of the faculty and students of the College of Engineering of the University of Illinois and the Illinois Society of Engineers and Surveyors at Urbana, Ill., on Jan. 18, on "The Organization and Work of a Modern Engineering Construction and Operating Company."

Mr. Leavitt L. Edgar, secretary of the Boston Electric Vehicle Club and son of President C. L. Edgar, of the Edison Electric Illuminating Company of Boston, was presented with a handsome nautical clock at the regular meeting of the club on Jan. 10 in recognition of his approaching departure from the ranks of bachelordom.

Mr. William V. Hester, secretary and treasurer of the *Brooklyn Daily Eagle* and a graduate of the Polytechnic Institute of Brooklyn, was elected a director of the Edison Electric Illuminating Company of Brooklyn and of the Kings County Electric Light & Power Company to fill the vacancy caused by the death of Mr. A. M. Young.

Mr. J. O. Binkley has been appointed superintendent of shops of the Dominion Power & Transmission Company, Hamilton, Ont., succeeding Mr. F. B. Griffith, who has been appointed superintendent of interurban lines of the company, vice Mr. A. Clarke, resigned. Mr. Binkley has been connected with the company for almost eighteen years.

Mr. A. J. Young, formerly with the Bristol (Tenn.) Gas & Electric Company, has been appointed commercial manager of the Galveston (Tex.) Electric Company. Mr. Fred. M. Lege, Jr., is general manager of the plant, which position he also held with the Brush Electric Light & Power

Company before the Galveston plant was acquired by the Doherty interests.

Mr. Frank H. Taylor, formerly vice-president of the Westinghouse Electric & Manufacturing Company, is on a short visit to this country. Mr. Taylor represents the Merganthaler linotype interest in Europe as director and general manager of the Linotype & Machinery Company, Ltd., with offices at 188 Fleet Street, London.

Mr. John F. Gilchrist, president of the National Electric Light Association, delivered a convincing address on "Electric Rates" at the annual meeting of the New Orleans Board of Trade on Jan. 3, in response to an invitation from the board extended on account of the interest created in the subject by an investigation of service rates being conducted by the Progressive Union.

Mr. Arthur S. Ives, for many years assistant general manager of the Poughkeepsie (N. Y.) Light, Heat & Power Company, has gone into consulting engineering work with Mr. R. A. Davidson at 58 William Street, New York. The firm will specialize in power-plant design, management of lighting properties, etc., and will also make examinations, reports, financial investigations and rate adjustments.

Mr. J. G. Henninger, illuminating engineer of the engineering department of the National Electric Lamp Association, gave an illustrated talk on "Industrial Lighting" before the Cleveland branch of the National Association of Stationary Engineers on Jan. 13. Mr. Henninger's talk was supplemented by Mr. H. C. Meredith, reflector engineer of the National Association, who discussed the characteristics of reflectors and reflecting surfaces.

Mr. Frederick C. Finkle has resigned as consulting engineer for the Southern California Edison Company to extend his activities along the line of general consulting practice. Mr. Finkle's engineering association with the company dates from 1898. Between 1898 and 1907 he held the position of chief hydraulic engineer of the company and designed and superintended the construction of seven hydroelectric plants, the largest of which was Kern River No. 1, of 30,000 kw rating. In 1907 he resigned his position as chief hydraulic engineer for the purpose of entering a consulting practice which has been carried on since that time.

Mr. Peter W. Sothman, chief engineer of the Hydro-Electric Power Commission of Ontario, was born May 20, 1870, at Haderslev, Denmark. The greater part of his life was spent in Germany, however, and he grew up and served the colors of his adopted country in the navy and shops at Hamburg. Later he entered the Technical High School at Charlottenburg, one of the ten high schools in Germany ranking with her universities, whence he graduated in mechanical and electrical engineering. In 1891 and for six years after Mr. Sothman was in the employ of Siemens & Halske as constructing engineer and manager of electric light and power properties, during which time he supervised the erection of stations at Grünberg and Taunus, Germany; Johannesburg, South Africa; Chemnitz, Saxony; Moscow, Russia, and Winau, Switzerland, with their extensive transmission systems. During this period he also spent some two years in the laboratory at Grünberg engaged in investigations in high-tension work, including lines, apparatus and insulators. From 1897 to 1905 Mr. Sothman was engaged by the Allgemeine Electricitäts Gesellschaft as chief engineer and director of its three-phase, high-tension generating station at Strassburg, which at that time had 216 miles of underground cable installed and 138 miles of overhead lines. While at Strassburg Mr. Sothman spent his spare moments in the laboratory studying high-tension phenomena, and even at that time his reputation was such as to win him recognition as an expert on high-tension work and he acted in that capacity for a number of German municipalities and also for the courts of Alsace-Lorraine and Baden. The government also extended to him a technical commission, and he was active on important committees of the Verein Deutscher Electrotechniker and served as a director of the technical school at Strassburg. It was during his connection with the Allgemeine Electricitäts Gesellschaft that the Académie Parisienne conferred on him the honorary degree of doctor. In 1905 Mr. Sothman came to New York and opened an office as consulting engineer, and since Sept. 1, 1906, he has been chief engineer of the Hydro-Electric Power Commission of Ontario. For this work he is eminently qualified. Brusque in aspect and manner, with an iron will and indomitable courage, he has withstood the chicanery and sophistry of politicians and brought to fruition one of the greatest pieces of high-tension engineering work in the world. Rooted and grounded in the principles of electrical and mechanical engineering characteristic of the German system of education, he has striven for the best in engineering regardless of cost, and with the accustomed bluntness of the Teuton he has held to his ideals and brushed aside every other consideration even when suggested by members of the commission. No member of his staff received an appointment on the recommendation of politicians and no municipality can depart one jot or one tittle from the specifications covering work to be connected with the hydroelectric system. The thoroughness and excellence of his work are recognized by both the commissioners and the entire province, who yield to him all the credit for the engineering skill with which the great task was carried on. The ability and efficiency of his staff and the complete harmony which pervades his entire organization attest the worth of Mr. Sothman as an executive and engineer.

PETER W. SOTHMAN.

Mr. William S. Turner, electrical engineer, has entered into association with Mr. John Reed, civil and hydraulic engineer, and Mr. Irving H. Sherwood, electrical and mechanical engineer, for practice in consulting engineering under the firm name of William S. Turner & Company, with offices at Portland, Ore. Mr. Turner, who is a graduate of Cornell University, was connnected for some years with J. G. White & Company and W. S. Barstow & Company. Mr. Reed, a graduate in civil engineering from the University of Maine, has engaged in steam-railroad and electric-traction work in this country, New Zealand, the Philippine Islands and South America. Mr. Sherwood, a graduate in electrical engineering from the Case School of Applied Science, was for a number of years a member of the firm of E. P. Roberts & Company, Cleveland, and has had a wide experience in the construction and management of electric-light and traction plants.

Obituary.

Mr. James McCormack, chief clerk of the Edison Electric Illuminating Company of Brooklyn, died Jan. 19 in the Prospect Heights Hospital. Mr. McCormack was born in Brooklyn in 1882 and was connected with the Edison company for six years. He was vice-president of the Brooklyn Company Section of the N. E. L. A. last year and also served on some of the important committees.

Mr. George W. Blodgett, for many years electrical engineer of the Boston & Albany Railroad, died recently at his home in Lakewood, N. J., at the age of sixty-two. Mr. Blodgett was a graduate of the Massachusetts Institute of Technology and entered the service of the Boston & Albany in 1880. For twenty-three years he was its electrical engineer and he equipped one of the express trains running between New York and Boston with electric lamps about 1887, which thus was one of the first, if not the first electrically lighted train in the country. Mr. Blodgett lectured on electrical subjects in many institutions of learning and was a member of the Boston Society of Civil Engineers and at one time an associate member of the American Institute of Electrical Engineers. After leaving the Boston & Albany Railroad Mr. Blodgett joined the department of yards and docks at the Brooklyn navy yard and more recently moved to New Jersey in order to safeguard the health of his family.

Construction.

BIRMINGHAM, ALA.—Arrangements have been made by the owners of the Tidewater Railway, which is being built from East Lake to Bessemer, to secure electricity to operate its street cars from the Tennessee Coal, Iron & Ry. Co. About 1000 kw will be required. The contract is for a period of two years. Before the expiration of the contract the Tidewater company will erect its own plant.

TUSKEGEE, ALA.—The installation of motor-driven pumps at the water-works station, which is now closed, is contemplated. Tungsten series street lamps will also be installed. Carl N. Browne is superintendent of the municipal electric-light plant.

SEWARD, ALASKA.—The Kenai-Alaska Gold Mining Co. is planning to erect an electric-power plant on its properties. J. R. Hayden is president.

DOUGLAS, ARIZ.—The Calumet & Arizona Mining Co. is planning to build an addition to its steam generating plant and also install new electrical machinery.

TEMPE, ARIZ.—The Salt River Valley Ry. Co. has applied for a franchise on Mill Avenue. Surveys are being made by the company for its proposed line between Phoenix and Scottsdale.

BATESVILLE, ARK.—The commissioners of the electric-light plant will install a 200-kva, three-phase, 2200-volt belted generator during the spring or summer. Second-hand machinery will be used if it can be found. W. H. Walkup is superintendent.

FAYETTEVILLE, ARK.—The Fayetteville El. Co. has not been awarded a contract to supply electricity in Springdale as reported in our issue of Jan. 6. The company has been asked to submit a proposition to furnish that town with electrical service. The question has not yet been decided. J. W. McLendon is superintendent.

FORT SMITH, ARK.—The Fort Smith Lt. & Trac. Co. will build 5 miles of new track during 1912.

LITTLE ROCK, ARK.—The Little Rock Ry. & El. Co. contemplates extending its railway from Pulaski Heights to the Highland Park line.

OSCEOLA, ARK.—Preparations are being made for the construction of a new municipal electric-light plant, bids for which will be asked about Feb. 1. The cost of the work is estimated at about $30,000. W. N. Gladson, of Fayetteville, is engineer in charge.

BAKERSFIELD, CAL.—The Kern River Oilfields Co. is planning to equip all its wells with electric motors. The cost of the installation is estimated at $175,000.

CHICO, CAL.—A deal has been closed by the Sacramento Valley Pwr. Co. and the Great Western Pwr. Co. whereby an auxiliary transmission line will be erected between Chico and the power plant of the Great Western Pwr. Co. at Big Bend, a distance of 15 miles.

LIVERMORE, CAL.—The Sierra & San Francisco Pwr. Co. contemplates extending its transmission lines to Livermore.

LODI, CAL.—The installation of an electrolier lighting system in the business section is under consideration.

LOS ANGELES, CAL.—The contract for hydraulic machinery for the San Francisco municipal power plant No. 1 on the aqueduct has been awarded to the Union Iron Works, San Francisco, for $194,000. The Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa., secured the contract for electrical machinery at $163,367.

MARTINEZ, CAL.—The Great Western Pwr. Co. contemplates extending its transmission line from Eckley along the bay shore to the California warehouses at Port Costa to supply electricity for lamps and motors to the storehouses there. Plans have also been made to extend the line along the waterfront westerly to Pinole to supply energy to manufacturing plants there.

PACIFIC GROVE, CAL.—The Pacific Improvement Co. is planning to build an electric railway from Pacific Grove to Pebble Beach. The Southern Pacific Railroad tracks will be used from Pacific Grove to Lake Majela and the railway will be constructed from Lake Majela to Pebble Beach, a distance of about 3 miles. Electricity to operate the road will be furnished from the power house at Del Monte.

PERRIS, CAL.—The Southern Sierras Pwr. Co. is planning to erect an electric substation here for which a site has been acquired.

PRINCETON, CAL.—The Northern California Pwr. Co. has purchased a site here on which it proposes to erect a substation.

RED BLUFF, CAL.—The Oro Wtr., Lt. & Pwr. Co. has purchased the interests of the Butte & Tehama Pwr. Co. & Irrig. Co. and the Sierra Irrig. Co. The Oro company is planning to erect additional plants and extend its transmission lines to Sacramento and on to San Francisco Bay. A large generating plant will be erected on Mill Creek.

ROSEVILLE, CAL.—The City Trustees have awarded the contract for lighting the city to the Great Western Pwr. Co. for a period of five years at 1½ cents per kw-hour. A committee has been appointed to negotiate with the Pacific Gas & El. Co. for its light and power system in this city.

SAN FRANCISCO, CAL.—The City El. Co. has awarded a contract for construction of new substation to Rainey & Phillips, San Francisco, at $9,943.

SAN FRANCISCO, CAL.—An electrolier lighting system will be installed on Bush Street from Market Street to Grant Avenue. The North Central Improvement Association is interested.

SAN FRANCISCO, CAL.—The California Pwr. & Mfg. Co. has executed a mortgage to secure a bond issue of $5,000,000, the proceeds to be used to pay the existing indebtedness and to acquire and develop properties.

SAN LEANDRO, CAL.—The residents and property owners have petitioned the Board of Trustees for the installation of electric lamps on Breed and Broadmoor Avenues.

TULARE, CAL.—The Home Tel. Co. is planning extensive improvements to its system.

WILLOWS, CAL.—Plans are being made for the erection of a hydro-electric plant near Willows. L. W. Warmoth, of Paskenta, Cal., is interested.

MANITOU, COL.—Work will begin at once on the construction of an aerial railway from Manitou to the summit of Pike's Peak by the Pike's Peak Aerial Railway Co. J. Mignolet is interested.

PUEBLO, COL.—The Arkansas Valley Ry., Lt. & Pwr. Co. is arranging for surveys for a proposed transmission line east from Pueblo tapping the towns of the irrigated Arkansas Valley to supply electricity to operate pumping plants.

BRANFORD, CONN.—An 11,000-volt transmission line is being erected from New Haven to Branford by the United Lt. & Wtr. Co. to supply electricity to operate the local system. One 300-kw rotary converter and three 100-kw Westinghouse transformers will be installed. E. T. Gilbert is superintendent.

DARIEN, CONN.—At a special town meeting held recently the Selectmen were authorized to enter into a contract with the Stamford Gas & El. Co. to install 125 electric street lamps. The cost of maintaining the system will be about $3,200 per year.

MERIDEN, CONN.—The Meriden El. Lt. Co. contemplates building an addition to its plant to provide space for new boilers.

MIDDLETOWN, CONN.—The Middletown El. Lt. Co. has authorized Henry Floy, consulting engineer, 165 Broadway, New York, to prepare plans and estimates for doubling the steam turbine and boiler capacity of its plant.

NEW HAVEN, CONN.—A permit has been granted to the United Illg. Co. to build an addition to its power house in Grand Avenue, near Mill River, to cost $4,800.

WASHINGTON, D. C.—Proposals will be received at the office of the chief signal officer, War Department, Washington, D. C., until Feb. 11, under proposal 656, for furnishing 30 miles single-conductor cable intermediate, type 44, in accordance with specifications 419-B, 96-B and drawing 106, and 150 miles single-conductor deep-sea cable, type 45, in accordance with specifications 420-A, 96-B and drawing 106, to be coiled and crated in closed freight cars. For further information address Capt. R. J. Burt, disbursing officer.

TAMPA, FLA.—The municipal committee of the Board of Trade has decided to ask the Tampa El. Co. and the Tampa Gas Co. to submit bids to the City Council for the installation of ornamental lamp standards carrying cluster lamps along the business portion of Franklin Street.

CAIRO, GA.—The light and water-works committee is contemplating establishing a day service for the summer. W. A. Clifford is superintendent.

CUTHBERT, GA.—Work will soon begin on the construction of an entire new municipal electric plant. The equipment will consist of one 250-hp engine direct-connected to a 150-kw, three-phase, 60-cycle generator. A 24-hour service will be established and electricity furnished for motors. J. B. McCrary & Co., of Atlanta, Ga., are engineers.

DARIEN, GA.—The Darien Ice & Lt. Co. contemplates the installation of an electric plant in connection with its ice plant to supply electricity to light the city and for commercial and residential lighting. Charles M. Tyson is president and Mayor Bluestein vice-president and general manager.

GRIFFIN, GA.—Three 150-kva transformers with station panel, incoming-line panel, two feeder panels and arc lamp panel will be installed in the substation, already erected, at a cost of $4,500. G. J. Drake is superintendent.

MONTICELLO, GA.—The City Council is negotiating with the Central Georgia Pwr. Co. to supply energy to operate the municipal electric-light plant. C. W. Oford is manager.

AURORA, ILL.—The Central Illinois Ry. Co., recently incorporated with a capital stock of $25,000, proposes to build an electric railway from Chicago to Muscatine, Ia.

CAIRO, ILL.—The Cairo El. & Trac. Co. is planning to build an addition to its power house, which with additional equipment will cost about $60,000.

CHAMPAIGN, ILL.—A power plant will be included in the new elevator to be erected here next spring by the Cleveland Grain Co., at a cost of $55,000. The John S. Metcalf Co., Chicago, Ill., is engineer.

CHAMPAIGN, ILL.—C. M. Caldwell has submitted plans to the Council for the installation of an electric-light system, to cost about $35,000. The plan calls for 724 lamps, 30 miles of underground cable and 30 miles of overhead construction.

CUBA, ILL.—Mr. Negley, Canton, Ill., is reported to be negotiating for the purchase of the municipal electric-light plant.

FARMINGTON, ILL.—The Farmington Lt. & Pwr. Co. has taken an option on the Fairview electric plant, pending renewal of franchise. If granted, it will connect its transmission lines with the Fairview system. Theodore Baas is president.

PAWPAW, ILL.—J. J. Beemer, of Pawpaw, contemplates the installation of an electric-light plant to supply electricity for street lighting and for commercial purposes.

URBANA, ILL.—The Kankakee-Urbana Trac. Co. has authorized G. M. Bennett, president, to arrange for the purchase of rails and other materials, including overhead equipment for its proposed railway between Urbana and Rantoul.

VIRDEN, ILL.—The Virden El. Lt. Co. has submitted a proposition to the City Council for the substitution of boulevard lamps for the present arc lamps about the public square.

WOODRIVER, ILL.—The Village Board has decided to enter into a contract with the Madison County Lt. & Pwr. Co. for lighting the streets of the village. A transmission line will be erected from the plant at Edwardsville to supply electricity in Woodriver and East Alton, where the company recently secured a franchise.

BATTLE GROUND, IND.—Arrangements are being made to connect Battle Ground with Brookston and Chalmers with a transmission line and install an electric-light system in each town. The three towns are about 12 miles apart. Electricity will be furnished by the Fort Wayne & Northern Trac. Co., which operates as far north as Battle Ground.

DECATUR, IND.—The City Council has appropriated $2,000 for the purchase of 50 new electric street lamps.

EVANSVILLE, IND.—Contracts will be awarded by the Evansville Rys. Co. for material to equip 7 miles of the Illinois Central Railroad tracks between Evansville and Henderson, Ky., for electrical operation. The company will purchase equipment for its new substation in Henderson in the near future.

GARRETT, IND.—Bids will be received by the City Council until Feb. 13 for furnishing and installing one 150-kva, three-phase, 2300-volt, 60-cycle steam-driven generator with exciter, switchboard, etc., in the municipal electric-light plant. W. W. Mountz is city clerk.

DAVENPORT, IA.—The Tri-City Ry. & Lt. Co. has appropriated $250,000 for improvements to the electric and gas service in the tri-cities. J. F. Porter is president.

EMERSON, IA.—The city of Emerson is considering the question of installing an electric-lighting system. It is proposed to erect a transmission line from the Glenwood El. Lt. & Pwr. Co.'s plant to furnish electricity to operate the system.

FOREST CITY, IA.—The Forest City El. Lt. & Pwr. Co. expects to rebuild its electric plant in the near future.

KEOKUK, IA.—Plans are being prepared for the installation of an ornamental lighting system on Main Street.

MITCHELLVILLE, IA.—The proposition to grant a franchise to construct an electric light and power plant will soon be submitted to a vote.

MOVILLE, IA.—Edgar Metcalfe is planning to install an electric-light plant here.

NEWTON, IA.—Improvements will be made to the municipal electric-light plant, including the installation of four new boilers during 1912. C. O'Leary is superintendent.

OELWEIN, IA.—The Oelwein Lt., Ht. & Pwr. Co. has recently installed a 100-kw, three-phase, 60-cycle generator and contemplates changing over its entire system to three-phase in a few months. W. Walker is manager.

REMSEN, IA.—The Council has granted Matthew R. Faber a franchise to install an electric light and power plant here.

SAC CITY, IA.—The Sac City El. Co. is planning to install an ice and refrigerating plant in connection with its electric plant and also installing another Corliss engine. It also contemplates the erection of a high-tension transmission line to Fonda, Lakeview and Lytton. H. W. Deininger is superintendent.

EUREKA, KAN.—R. M. Wilson, owner of the local electric-light plant, contemplates the erection of several transmission lines in the farming district. A line may be erected to Severy if a day service is established.

HIGHLAND, KAN.—The Home Tel. & El. Co. contemplates the installation of a storage battery or a small generating unit during the coming summer to supply electricity for day service. J. H. Bender is manager.

LAWRENCE, KAN.—The installation of an ornamental street-lighting system in the business district is under consideration. The Lawrence Ry. & Lt. Co. has offered to furnish the standards and lamps, provided the city will pay for current consumed. Albert Emanuel, of Dayton, Ohio, is president of the company.

LIBERAL, KAN.—The Liberal Lt., Ice & Pwr. Co. contemplates the purchase of a 200-hp oil engine and a 150-kw, 60-cycle, three-phase, 2300-volt generator. H. W. Magruder is president and manager.

OSAGE, KAN.—The installation of a 100-hp oil engine in the municipal electric-light plant is contemplated. George Dawson is manager.

WICHITA, KAN.—Preliminary arrangements are being made by the Kansas Gas & El. Co. for the installation of 250 ornamental lamp standards, each carrying one inverted magnetite arc lamp, to be maintained with underground wires. Present pole lines will be removed along the principal streets. H. S. Sladen is manager.

FALMOUTH, KY.—Bids will be received by N. C. Ridgeway, Mayor, until Feb. 1 for the installation of an electric-light plant, to cost about $7,500. Anderson & Frankel, of Lexington, Ky., are engineers.

HICKMAN, KY.—The Allen Engineering Co., of Memphis, Tenn., has been awarded the contract for additional machinery for the electric plant of the Hickman Ice & Coal Co.

LOUISVILLE, KY.—The Louisville Ltg. Co. is planning to extend its transmission lines to supply electricity for lamps and motors through the eastern part of Jefferson and Oldham Counties.

LOUISVILLE, KY.—The Louisville Ry. Co. has purchased two franchises. One franchise provides for the construction of a cross-town line 7 miles in length; the other calls for the construction of a railway extending half a mile from Bonnycastle Avenue to the new city limits.

DONALDSONVILLE, LA.—The Council is considering the installation of oil engines and three-phase, 2300-volt generators in the municipal electric-light plant. George V. Borde, of New Orleans, is consulting engineer and E. A. Thibodeaux superintendent.

KENTWOOD, LA.—Surveys have been made with a view to establishing an electric-light plant here.

PATTERSON, LA.—A company has been organized to establish an electric-light plant here.

ASHLAND, MAINE.—The Ashland El. Co. contemplates extending its transmission lines to Masardis, a distance of 10 miles, next summer. C. A. Flint is secretary and manager.

CUMBERLAND, MD.—The City Council has adopted a resolution to make arrangements to utilize the pumping station for a municipal electric-light plant as soon as the Evitts Creek gravity water system is completed. The only additional outlay will be for electrical machinery, poles, wiring, etc., the cost of which is estimated at from $75,000 to $80,000. It is proposed to supply electricity for commercial purposes.

KENSINGTON, MD.—The Town Council contemplates appealing to the Legislature for authority to increase the tax rate to raise funds to provide for lighting the streets with electricity.

SALEM, MASS.—The Gas and Electric Light Commission has authorized the Salem Gas & El. Co. to issue 4400 additional shares of stock at $90, par value $50, the proceeds of 2527 shares to be used for payment of outstanding indebtedness and the balance for the construction of underground conduits.

COLEMAN, MICH.—The Consol. Ltg. & Pwr. Co. has purchased the local electric-light plant, owned by Bodfish & Whitehead. The company is now building a transmission line from Clare to Gladwin and will begin work at once on the erection of a line from Clare to Coleman. C. S. Abbott, of Detroit, is vice-president and general manager.

FRANKENMUTH, MICH.—A company will be formed to promote the installation of an electric-light plant here.

HUDSON, MICH.—The Hudson El. Lt. Co. is planning to establish a day service within six months and will install a number of small motors from ½ hp to 15 hp. G. F. Avis is secretary and manager.

MUSKEGON HEIGHTS, MICH.—The City Council has accepted the bid of the Grand Rapids-Muskegon Pwr. Co. to light the streets of the city for a period of ten years and to furnish electricity for commercial lighting.

OXFORD, MICH.—The Council is contemplating the purchase of a 125-kva, three-phase, 1100-volt, 60-cycle generator direct-connected to a compound condensing engine and changing the system to three-phase and will probably be in the market for some three-phase motors. H. E. Allen is superintendent.

TRAVERSE CITY, MICH.—A movement is on foot for the consolidation of the Boardman River El. Lt. & Pwr. Co., and the Queen City El. Lt. & Pwr. Co., both of Traverse City, which now have three dams on the Boardman River, and when the consolidation is effected another dam will be built at a cost of $250,000. The plants are to be taken over by New York capitalists, who will immediately construct a street railway and interurban lines.

AURORA, MINN.—The Northern Pwr. Co., recently incorporated with a capital stock of $100,000 by J. H. Simons, R. P. Pearsall, F. C. Witte and P. M. Johnson, of Aurora, and D. A. Reed, of Duluth, proposes to build and operate a hydroelectric plant on the St. Louis River, south of Aurora.

GRACEVILLE, MINN.—Plans are being considered for the construction of a new municipal electric plant or reconstruction of the present system. The village authorities would like to communicate with electricians and engineers capable of taking charge of the plant. John A. Green is village recorder.

MINNEAPOLIS, MINN.—Estimates of cost for the proposed municipal electric-light plant have been made by the Oscar Claussen Engineering Co., of St. Paul, and Charles L. Pillsbury, of Minneapolis. The first plan calls for an expenditure of $885,275 and the second $680,220. With improved city lighting equipment the cost would be about $16,500 additional. With real estate and other expenditures during construction the cost will amount to about $1,000,000.

LAUREL, MISS.—The Laurel Lt. & Ry. Co. has purchased the electric plant of the Gulf States Investment Co. and will make extensions to same. S. M. Jones is secretary.

MACON, MISS.—The erection of high-tension transmission lines to two adjoining towns is contemplated by the managers of the municipal electric-light plant. G. B. Baskerville is superintendent.

CAPE GIRARDEAU, MO.—The Lt. & Devel. Co., St. Louis, has purchased the controlling interest of the Cape Girardeau Wtr. Wks. & El. Lt. Co. Improvements are contemplated to the system.

CAPE GIRARDEAU, MO.—The City Council has called a special election to be held in April to vote on a bond issue for the purpose of building an electric-light plant or purchasing the plant now owned by the St. Louis Lt. & Devel. Co. The charter of the St. Louis Co. expires in 1914.

CARTHAGE, MO.—The Business Men's League is promoting the installation of an ornamental lighting system in the business section. The Board of Public Works has agreed to furnish the lamps and maintain same, provided the merchants will pay for the installation of the standards.

CHILLICOTHE, MO.—Extensions to the municipal electric-light plant, to cost $10,000, are under consideration.

FREDERICKTOWN, MO.—The Fredericktown Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by E. Gates, A. J. Boardman and R. G. Stevenson.

JENNINGS, MO.—The Council has granted a franchise to C. C. Johnson to operate an electric-light plant here.

KANSAS CITY, MO.—The La Plata Ice, Ht. & Pwr. Co. has been incorporated with a capital stock of $25,000 by G. A. Sickler, R. J. Lafilte and H. J. Mairens.

MEXICO, MO.—The Mexico Pwr. Co. has been incorporated with a capital stock of $300,000 by S. M. Locke, E. K. Locke and P. E. Locke.

POPULAR BLUFF, MO.—The Lt. & Devel. Co., of St. Louis, has acquired the controlling interest in the Popular Bluff Ltg. Co. Improvements are contemplated to the plant.

LIBBY, MONT.—Investigations have been made in connection with the development of the Kootenai Falls water-power project. It is proposed to develop 100,000 hp, which, it is said, will be transmitted to Cœur d'Alene and other industrial centers. The total cost of the plant is estimated at $6,000,000.

DAVID CITY, NEB.—The Fairbanks-Morse Co., Omaha, has submitted a proposition to establish an electric-light plant here, if granted a five-year franchise, and at the end of that time agrees to turn the plant over to the city or accept a new franchise.

MARQUETTE, NEB.—The installation of a municipal electric-light plant and water-works system is under consideration.

OMAHA, NEB.—The Omaha El. Lt. Co. has submitted a proposition to the City Council offering to substitute 100 flaming-arc lamps for an equal number of the present lamps in the business district at an additional cost of $10 each per year.

WHIPPANY, N. J.—The question of installing an electric street-lighting system here is under consideration.

DEMING, N. M.—The Deming Land & Pwr. Co., recently organized at Silver City, contemplates the construction of a large electric-power plant in Deming and the erection of an extensive transmission system and also the installation of a number of irrigation pumping plants. The company is capitalized at $250,000 and the incorporators are W. D. Murray, E. A. Layne, M. F. Downs and T. L. Lowe.

CAMDEN, N. Y.—Improvements will be made to the municipal electric-light plant, including the installation of a 225-hp Diesel engine. The cost of the work is estimated at $18,000. Horace McDaniels is engineer.

EAST ROCHESTER, N. Y.—The Despatch Ht., Lt. & Pwr. Co. is planning to extend its transmission lines to Macedon. The village lighting plant will be utilized and the output increased by the installation of a 200-hp transformer. A 24-hour service will be established.

KENMORE, N. Y.—The Buffalo General El. Co. has applied to the Board of Village Trustees for a franchise to supply electricity for lamps, heat and motors here.

MINEOLA, N. Y.—The Nassau Lt. & Pwr. Co. has received authority from the Public Service Commission to issue $158,000 in bonds, the proceeds to be used for improvements and extensions.

MORRISVILLE, N. Y.—The local electric-light plant has been purchased by the milling company of West Eaton. Improvements will be made to the plant and new machinery installed.

NORWOOD, N. Y.—The citizens have voted to grant the Northern Pwr. Co. a franchise to extend its transmission lines into Norwood.

OWEGO, N. Y.—The Owego Lt. & Pwr. Co. contemplates improvements to its system involving an expenditure of about $15,000 during 1912.

ROCHESTER, N. Y.—The installation of an electric-lighting system in the territory lying between the city line and the barge canal is under consideration.

ROCHESTER, N. Y.—The Rochester Ry. & Lt. Co. has decided to amend its charter so as to enable it to operate in Livingston, Ontario and Wayne Counties.

ST. GEORGE, N. Y.—Bids will be received at the office of the president of the borough of Richmond, Borough Hall, St. George, New Brighton, N. Y., until Jan. 30 for furnishing cable, including labor, blocks, tackle and other appliances to lay, draw into ducts and connect up complete an electric street-lighting system, including the connecting up of the street lamp-post lanterns at the St. George ferry approach, contract No. 9. George Cromwell is borough president.

SEA CLIFF, N. Y.—The Village Trustees have granted the Glen Cove Lt. & Pwr. Co. a 25-year franchise to supply electricity here. The company will apply at once to the Public Service Commission for permission to extend its transmission lines in Sea Cliff. Under the terms of the franchises the company will furnish electricity for the first five years at 9 cents per kw-hour.

LITTLETON, N. C.—The city will install an electric-light plant for which bonds for $10,000 have been issued. T. J. Miles is Mayor.

AKRON, OHIO.—A resolution has been presented to the Council authorizing the Board of Control to engage an engineer to prepare plans and estimates of the cost of a municipal light, heat and power plant.

BARBERTON, OHIO.—The installation of a municipal electric-light plant in connection with the pumping station is under consideration.

BRYAN, OHIO.—Improvements are contemplated to the municipal electric plant and water-works system, to cost about $46,000.

CINCINNATI, OHIO.—Plans are being considered for the installation of an ornamental lighting system in the business district.

CLEVELAND, OHIO.—Mayor Baker has submitted a proposition to the Cleveland El. & Illg. Co. for the purchase of its property at its physical value.

CLEVELAND, OHIO.—A movement is on foot to extend the transmission lines from the municipal electric-light plant at Brooklyn to the village of Parma.

CLEVELAND, OHIO.—The Cleveland, Randall & Eastern Ry. Co., recently incorporated with a capital stock of $10,000 by R. H. Jamison, Harley S. Adams, Claude W. Shimmon, D. S. Sheet and H. W. Dickson, proposes to generate and distribute electricity.

DEFIANCE, OHIO.—The Board of Public Affairs has decided to improve the lighting system in the business district.

ELYRIA, OHIO.—Proposals will be received at the office of the County Commissioners of Lorain County, Court House, Elyria, Ohio, until Feb. 12 for erecting a three-phase electric trqansmission line about 1 mile in length, furnishing transformer, meters, lightning arresters, switches, etc.; also for furnishing and installing complete wiring fixtures and distributing system for electric lighting at the Lorain County Infirmary, plans and specifications for which are on file in the office of T. L. Gibson, county engineer. Charles Chandler is clerk of commissioners.

PORTSMOUTH, OHIO.—The Portsmouth St. Ry. & Lt. Co. contemplates extending the Sciotoville street railway to Wheelersburg in the spring.

SPRINGFIELD, OHIO.—The city has decided to establish a municipal lighting plant and $500 will be appropriated to prepare plans for same.

HAMMON, OKLA.—The Board of Trustees has awarded the contract for the construction of an electric-light system and water-works to Hunter & Hunter, Oklahoma City, for $15,095.

PORUM, OKLA.—The contract for the construction of the proposed municipal electric-light plant and water-works system has been awarded to Kennedy & Fleming, Oklahoma City. M. A. Earl & Co., Muskogee, are engineers.

DENZER, ORE.—The Lobster Valley & Five Rivers Tel. Co. will make extensive improvements and extensions to its system.

HILLSBORO, ORE.—The Southern Pacific Co. has applied for a franchise to operate an electric railway on certain streets in the city.

PANAMA.—Proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 3 for furnishing hose, packing, gaskets, tape, rubber gloves, lamps, sockets, potheads, fuses, electric switches, wire pipe fittings, etc. Blanks and general information relating to this circular (No. 677) may be obtained from the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and 614 Whitney-Central Building, New Orleans, La.

ATHENS, PA.—The Borough Council has accepted the contract submitted by the Sayre El. Co. for lighting the borough for a period of five years. Electricity for lighting the municipal buildings will be furnished at 6 cents per kw-hour.

CARLISLE, PA.—The Cumberland Ry. Co. is planning to build an electric railway between Newville and Chambersburg, a distance of 22 miles.

CHARLEROI, PA.—The West Side El. St. Ry. Co. is planning to build an extension from Charleroi to Bentleyville, a distance of 9 miles, during 1912.

JOHNSTOWN, PA.—The Johnstown Trac. Co. is planning to extend its railway from Walnut Grove to Geistown and from Geistown to Moxham.

PITTSBURGH, PA.—With a view of furnishing electricity in Pittsburgh the Joseph R. Paull Investment Co. has been organized by Mr. Paull, Joseph C. Trees, M. L. Benedum and others. It is proposed to

construct a lake 52 miles long along the Clarion River. The plans which are now being considered by the State Water Supply Commission contemplate an expenditure of about $10,000,000.

SCRANTON, PA.—Owing to the great increase in business the Scranton El. Co. has decided to double the output of the plant which it is erecting on North Washington Avenue. The change in the plans will involve an expenditure of more than $250,000. Duncan T. Campbell is general manager.

SHARPSVILLE, PA.—The installation of a municipal electric-light plant here is under consideration.

WEATHERLY, PA.—At an election held recently the proposition to issue $10,000 in bonds for a municipal electric light and power plant was carried.

REMSEN, S. D.—The Council has granted a franchise to M. R. Faber, of Remsen, to install an electric plant, subject to ratification by the voters.

CHATTANOOGA, TENN.—Work will begin at once by the Retail Merchants' Association on the installation of a cluster lighting system in the business district. Electricity for maintaining the lamps will be donated by the Chattanooga Ry. & Lt. Co. for the first year. Fifty-six standards will be erected.

DYER, TENN.—The Dyer Fruit Box Mfg. Co. has awarded the Allen Engineering Co., of Memphis, Tenn., a contract for additional machinery for its electric-light plant.

BAIRD, TEX.—The Baird Lt. & Ice Co. is planning to erect three buildings. The equipment will include one 75-kw generator, engine and ice machine. E. W. Smith is secretary and manager.

DALLAS, TEX.—The Gulf Pipe Line Co. has applied to the County Commissioners for a franchise to build its pipe line in Dallas County from Saltillo to a point near Fort Worth and also for permission to erect and operate a telephone and telegraph line along the same route.

DALLAS, TEX.—The Board of Municipal Commissioners has accepted the bid of the Dallas El. Corpn. to light the streets of the city for a period of three years at $56 per lamp per year. The company also agrees to furnish electricity free of charge for 1000 incandescent lamps during the state fair.

DECATUR, TEX.—Bonds to the amount of $18,000 have been voted to purchase the local electric plant and water-works system.

HONDO, TEX.—The Commissioners' court has granted a franchise to W. B. Sorelle, of San Antonio, to build and maintain electric-light plants in Hondo and Lacoste.

KENEDY, TEX.—The City Commissioners have authorized the installation of a street-lighting system here. Twenty or more lamps of 50 cp will be installed.

PLAINVIEW, TEX.—The Northwest Texas Tel. Co. is planning to build a new building and erect a copper toll line from Plainview to Floydada, at a cost of about $35,000.

PORT ARTHUR, TEX.—The Port Arthur Wtr. Co. is planning to install a 1000-kw turbo-generator and a battery of boilers.

SAN ANGELO, TEX.—Preparations are being made for the installation of an ornamental lighting system in the business district. The street-lighting contract with the local company has expired.

SALT LAKE CITY, UTAH.—The Earl Pwr. Co. is planning to develop a power site in American Fork Canyon. The company is capitalized at $250,000 and the officers are: C. W. Earl, president; F. L. Dodge, vice-president, and W. H. Gregory, secretary and treasurer.

FLOYD, VA.—The Floyd El. Pwr. Co. has purchased a concrete dam across Little River and will erect a power plant to generate electricity for lamps and motors. S. G. Proffitt is president.

WEST POINT, VA.—The People's Lt., Ht. & Pwr. Corpn. is planning to improve its power station and install new equipment. C. L. Maskey is president.

ELENSBURG, WASH.—The city is planning to make improvements to the municipal electric-light plant and install a cluster street-lighting system. The cost of the entire work is estimated at $35,000.

GRANITE FALLS, WASH.—The property of the Granite Falls El. Co. has been acquired by F. I. Anderson. It is understood that improvements and extensions will be made to the plant.

HOQUIAM, WASH.—The Grays Harbor Ry. & Lt. Co. is planning to extend its local system from River Street to Queen Avenue.

QUINCY, WASH.—The Quincy Valley Water Users' Association has secured a power site near Wenatchee Lake and contemplates the installation of a hydroelectric power plant.

SEDRO-WOOLLEY, WASH.—The Whatcom County Ry. & Lt. Co. is planning to erect a new substation to supply electricity for its railway system.

MARLINTON, W. VA.—The Marlinton Service Co. is planning to establish water-works, power plant and ice factory here. The company is capitalized at $30,000. John and Dwight Alexander are interested.

MORGANTOWN, W. VA.—The South Morgantown Trac. Co. is planning to make extensions to its system in Greenmont and South Park, for which surveys will be begun at once and contracts for ties and rails awarded in the near future.

MOUNDSVILLE, W. VA.—The Moundsville Elec. Co. contemplates the installation of additional equipment, including new generators, at a cost of about $50,000. A 24-hour service will be established.

WELLSBURG, W. VA.—The installation of an electric-light plant in connection with the pumping station of the water-works system is under consideration.

BELOIT, WIS.—The Wisconsin Commission has authorized the Beloit Wtr., Gas & El. Co. to issue $900,000 in bonds, the proceeds to be used to take up outstanding obligations and for improvements and extensions to its system.

KNOWLTON, WIS.—The Battle Island Co. has been authorized to issue $100,000 in capital stock, the proceeds to be used for the purpose of acquiring a dam site and 3500 acres of flowage lands on the Wisconsin River, near Knowlton. The company proposes to build a hydroelectric plant to develop 2300 hp for transmission to Neenah, 72 miles distant. Electricity will also be supplied in Oshkosh and Fond du Lac.

VANCOUVER, B. C., CAN.—The British Columbia El. Ry. Co. has awarded contracts for hydraulic and electrical equipment for its generating plant on the North Arm of Burrard Inlet, which will involve an expenditure of about $1,000,000 and will increase the output of the plant by 42,000 hp. The company is also preparing plans for development of other power sites, which will bring its total output up to 200,000 hp.

WINNIPEG, MAN., CAN.—Sealed proposals will be received by the chairman Board of Control, Winnipeg, until March 1, for furnishing and installing a 5,000,000-gal. horizontal turbine pump driven by an induction motor, direct-connected. Plans and specifications and form of tender may be obtained at the office of the city engineer, 223 James Avenue, Winnipeg. M. Peterson is secretary.

TRURO, N. S., CAN.—The Town Council has been authorized to secure estimates of the cost of installing and maintaining a municipal plant here.

BRANTFORD, ONT., CAN.—A by-law authorizing the Council to enter into a contract with the Hydro-Electric Commission for hydroelectric power will probably soon be submitted to the ratepayers.

CENTRALIA, ONT., CAN.—At an election held recently the ratepayers voted in favor of the by-law to secure electricity from the Hydro-Electric Commission.

CREDITON, ONT., CAN.—The by-law to enter into a contract with the Hydro-Electric Commission for electrical power was carried at an election held recently.

DASHWOOD, ONT., CAN.—At an election held recently the ratepayers voted in favor of the by-law to enter into a contract with the Hydro-Electric Commission for electricity.

KINGSTON, ONT., CAN.—The Grand Trunk Ry. Co. has asked the City Council to provide electricity to the amount of 1000 hp to operate its drills at the granite quarry at Tuttle's Hill. The Council will take the question up with the Hydro-Electric Commission at once.

LAKEFIELD, ONT., CAN.—The town proposes to install a substation and distributing system at a cost of about $8,000. Electricity for operating the system will be secured from the Hydro-Electric Commission.

LONDON, ONT., CAN.—Plans are being considered for extending the cluster lamp system on Dundas Street to the fair grounds and on other streets in the business district and also for extensions to the lighting system in the residential section and the installation of an extensive lighting system in Springbank.

PORCUPINE, ONT., CAN.—Application will be made to the next Legislature Assembly by the Porcupine-Rand Belt El. Ry. Co. for a charter to build an electric or steam railway from McGarry to Doyle.

TORONTO, ONT., CAN.—Plans are being prepared for the construction of a 3-mile electric railway to serve a portion of the suburban district around Toronto.

MONTREAL, QUE., CAN.—The Eastern Canada Pwr. Co., which was organized for the purpose of building a dam on the St. Lawrence River near Montreal, is reported to have applied to Parliament for permission to divert the whole of the river at Coteau and Cedar Rapids just above Montreal and take the waterway nearly one-half mile out of its course. It is proposed to provide for navigation of the river by replacing hydraulic locks below the power house. Electricity generated at the plant will be transmitted to Kingston, Ottawa, Quebec and Sherbrooke.

QUEBEC, QUE., CAN.—The St. Maurice Hydraulic Co. will petition the Legislature at Quebec for authority to build storage and regulating dams on the St. Maurice River and tributaries.

MADERA, CHIHUAHUA, MEX.—The Mines Co. of America is planning to build a new power plant in Madera. A transmission system will be erected to its mines at Dolores.

PUEBLA, MEX.—The Puebla Tramway, Lt. & Pwr. Co. has issued $3,000,000 in bonds, the proceeds to be used for extensions to its electric street-railway system and for the purchase of new equipment.

SAN DIMAS, DURANGO, MEX.—The Candelaria Consol. Mining Co. is planning to build a new hydroelectric power plant. The headquarters of the company are located in San Francisco.

New Industrial Companies.

THE DOWNING SMITH COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $5,000 to manufacture and deal in electrical machinery and supplies. The incorporators are: C. Voorhees, Ingall H. Harreid and Harry D. Irwin.

THE ELECTRIC MAGNETIC APPLIANCE COMPANY, of Cleveland, Ohio, has been chartered with a capital stock of $100,000 by Robert Williams, M. Goodhue, J. A. Currie and S. H. Blakeslee.

THE ELECTRIC-LENS SIGN COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $100,000 by J. Gaffney, Leo Meyberg, G. H. Bradner and R. N. Fitch.

THE EUREKA ELECTRIC & ENGINEERING COMPANY, of San Francisco, Cal., has been incorporated with a capital stock of $75,000 by E. E. and E. L. Combs, O. F. Metz and H. L. Morrison.

THE B. S. SPRAGUE ELECTRICAL COMPANY, of Marietta, Ohio, has been incorporated with a capital stock of $10,000 to do an electrical, gas and blasting business. The incorporators are: Harry T. Sprague, P. O. Sprague, A. T. Williamson and others.

THE INTERNATIONAL FUSE LIGHTER & ELECTRIC MANUFACTURING COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $1,000,000 by H. H. Mears, J. Auchell, W. W. Bearman and D. M. Potter.

THE WADE-GOUGH ELECTRIC COMPANY, of Los Angeles, Cal., has been incorporated with a capital stock of $10,000 by K. L. Wade, P. G. Gough and E. E. Kelly.

New Incorporations.

BIRMINGHAM, ALA.—The Horne Alabama Ry. & Pwr. Co. has been incorporated by H. Horne, of Macon, Ga.; W. H. Taylor, of Montgomery, and J. A. Horne, of Macon, for the purpose of developing various water-powers in Alabama. The present scheme involves the development of the water-power of the Coosa, Tallapoosa and Tennessee Rivers. H. Horne is secretary and treasurer.

NEEDLES, CAL.—The Needles Gas & El. Co. has been incorporated with a capital stock of $100,000 by Henry Torchiana, B. L. Devol and A. Mildreth, of Los Angeles.

PLACERVILLE, CAL.—The Camino, Placerville & Lake Tahoe Ry. Co. has been chartered with a capital stock of $1,000,000 to build an electric railway between Camino and Placerville. The incorporators are: C. B. Dabaher, B. Sair and C. F. Wood, all of San Francisco. The main offices of the company are in San Francisco.

SAN BERNARDINO, CAL.—The Citrus Belt Gas Co. has been incorporated with a capital stock of $1,500,000 to operate electric and gas plants in this section. The company has taken over the plant of the San Bernardino Valley Gas Co. The incorporators are: A. M. Ham, E. D. Roberts, Z. T. Bell, of Los Angeles, Cal.; E. S. Moulton, of Riverside, and F. P. Morrison, of Redlands.

BEARDSTOWN, ILL.—Articles of incorporation have been filed for the Beardstown Street Ry. Co. with a capital stock of $50,000 to build an electric railway in Beardstown. The incorporators are: Stephen H. Cummins, J. F. Adkins and C. B. Meredith.

Trade Publications.

ELECTRICITY IN MINING.—The British Thomson-Houston Company, of Rugby, England, has issued a handsome "mining calendar" for 1912, on each page of which is illustrated some piece of electrical apparatus manufactured in the interests of mining engineers.

DIARY CALENDAR FOR 1912.—The Archbold-Brady Company, manufacturers of steel transmission structures and catenary bridges, Syracuse, N. Y., has issued in convenient form a diary calendar for the year 1912. The diary consists of fifty-two weekly sheets, each provided with space for daily memoranda.

RESISTORS.—The Wirt Electric Specialty Company, Germantown, Pa., describes the "Di-el-ite" resistance units in Bulletin No. 1106. These are adapted for signaling systems, telephone and telegraph work, motor and lamp regulation, experimental work, etc. The insulation is an artificial stone capable of withstanding temperatures as high as 800 deg. Fahr.

ICE-MAKING PROFITS FOR CENTRAL STATIONS.—With this title the Baker Ice Machine Company, Omaha, Neb., has issued a convincing pamphlet as to the profitableness of the central-station ice-making auxiliary. Figures are given of a census of 130 central stations having such auxiliaries, and in only four instances were the reports unfavorable.

RENEWABLE CARTRIDGE FUSES.—The Economy Fuse & Manufacturing Company, Pittsburgh, Pa., has issued a catalog of National Electric Code standard-rating, renewable cartridge fuses. In these the active fuse element is brought into direct contact with the copper blades at the end, the blades being held parallel and in proper position at all times by a very simple construction.

ILLUMINATION.—The Macbeth-Evans Glass Company, Pittsburgh, Pa., has issued a book on scientific illumination. The work is got up for the layman and contains brief, clear and accurate statements of the main facts on illuminating engineering, such as any business man may find suggestive and useful. All of the various forms of lamps on the market are given consideration, as well as the various methods of distributing the light.

VITRIFIED CONDUIT.—The H. B. Camp Company has issued an illustrated catalog on its vitrified salt-glazed conduit for electrical subways. The contents of the catalog are divided into the following chapters: Manufacture, shipping facilities, Camp quality, inspection, specifications, damage to overhead construction, conduit sections, dimensions, underground transmission, railway signaling, cost table, analyzing cost, suggestions for laying manholes and compression tests.

AUTOMATIC MOTOR STARTERS.—Bulletin No. 1016, published by the Electric Controller & Manufacturing Company, Cleveland, Ohio, describes, besides giving the prices, ratings and outline dimensions, the company's automatic motor starter for non-reversing direct-current motors. The starter in its simplest form comprises a bank of starting resistance and a train of magnetically operated switches for cutting out this resistance. The actuating windings of the switches are adapted for connecting in series with the motor to be started, and the switches possess current-limit relays in addition.

RAUSCH & LANG'S ELECTRICS.—The Rausch & Lang Carriage Company, of Cleveland, Ohio, has issued a catalog of its line of electric carriages which takes a high rank even among automobile catalogs, which as a class are the handsomest trade publications issued in this country. Several illustrations in subdued colors are extremely artistic in effect, and the same is true of the ornamentation of the type pages, consisting of sprigs of flowers and butterflies in colors. One section of the catalog is devoted to a description of the details of the motors and accessories, accompanied by numerous illustrations.

FIXTURES, SOCKETS, SHADES AND REFLECTORS.—A very complete catalog, known as Bulletin No. 150, has been issued by the Federal Sign System (Electric), of Chicago and New York. It describes the entire Federal line of fixtures, steel shades, lock-clamp sockets, bushings and supplies. Illustrations, dimensions and prices are also given, the whole making a pamphlet of seventy-two pages. New porcelain-enameled steel fixtures and shades are listed. The former can be assembled in numerous combinations to suit varying requirements of illumination, and the latter are supplied in either the concentrating or diffusing type. These fixtures and shades can be used to make a variety of effective steel units. Several pages are devoted to new low-priced art-glass portables, hall lamps and pedestals. The bulletin as a whole makes a compact and useful catalog for reference.

Business Notes.

THE H. W. JOHNS-MANVILLE COMPANY has moved its Louisville (Ky.) office from the Lincoln Savings Bank Building to 205 Paul Jones Building. The office will be in charge of Mr. J. R. Chowning.

THE KELMAN ELECTRIC & MANUFACTURING COMPANY has moved into its new factory at 1650 Naud Street, Los Angeles, Cal., with greatly increased facilities for manufacturing oil switches for high-voltage work.

THE EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN has moved the offices of its electrical construction department to 569 Fulton Street, Brooklyn. The superintendent of the department is Mr. E. W. Babcock.

MR. S. A. STAEGE, consulting hydroelectric engineer, of Watertown, N. Y., has taken into partnership Mr. R. H. Bennett, of New York, and the firm name is changed to Staege & Bennett. The firm will continue to make a specialty of hydroelectric and steam engineering.

MR. HARRY P. SMITH, who has been connected for some years with the Commonwealth-Edison Company, Chicago, has joined the Reynolds Electric Flasher Company and will visit electric sign manufacturers, billposting and bulletin firms, central stations, contractors, etc.

STERLING ELECTRIC COMPANY.—The Minneapolis Electric Motor Company has changed its name, owing to confusion with similar names, to the Sterling Electric Company. The company will, as in the past, do business as electrical contractor and jobber of machinery, electrical supplies and ignition apparatus.

THE MINERALLAC ELECTRIC COMPANY, Chicago, Ill., will issue during the present month its new perpetual catalogue, containing listings of all its products. There will be four folios, devoted respectively to insulating materials, potential detectors, line material and maximum-demand indicators, including printometers, for which the Minerallac company acts as agent. Persons desirous of receiving the new catalogue and those with changes in mailing address should advise the company.

OHIO TOWNS FOLLOW EXAMPLE OF WARREN IN STREET LIGHTING.—The following Ohio towns have followed the well-known example of Warren and have placed orders and made contracts for "Mazda" series street-lighting systems: Salem, Leetonia, Lowellville, Lisbon, Niles, Garrettsville, Mantua, Medina and Windham. The Sterling Electrical Manufacturing Company, of Warren, which was largely

instrumental in planning the installation in that place, has also been instrumental in bringing about and working out the details of the installations in these other towns.

DUPLICATOR MANUFACTURING COMPANY.—Mr. William J. Miskella, for several years in the engineering departments of the Western Electric Company, has become interested in the Duplicator Manufacturing Company, 970 Old Colony Building, Chicago, Ill. He will devote his time to the application in engineering and other general office departments of the duplicator which this company makes. The duplicator is a labor and material-saving machine which does away with the use of carbon paper and other hand processes of duplicating and is said to have a wide application in the making of sketches, drawings, appraisal and other special report forms, large and small.

NAVY ORDER FOR INCANDESCENT LAMPS.—The Columbia Incandescent Lamp Company has recently received from the United States Navy Department two orders each calling for 25,000 clear and 5,000 frosted 25-watt, 125-volt Columbia drawn-wire "Mazda" lamps. Tests of drawn-wire lamps on battleships showed that these lamps are suitable for any kind of service conditions on board ship. After a target practice with 12-in. guns on the U. S. S. *Delaware* it was found that one-third to one-half of the carbon lamps on board the vessel were put out of commission, while of the twelve drawn-wire "Mazda" lamps which were placed in the compartments immediately beneath the large guns where vibration was greatest none was noticeably affected.

GOULDS COMPANY NEW BUILDINGS DEDICATED.—The completion of the three new buildings of the Goulds Manufacturing Company, Seneca Falls, N. Y., was celebrated Friday evening, Jan. 19, by a grand ball given by the Goulds Mutual Benefit Association. The two new machine shops used for the ball were handsomely decorated and equipped with special illumination for the occasion. One was used for dancing and the other was fitted up as a dining-hall and cloak-room. It also contained card tables for those who did not care to dance. From 8 until 10 p. m. a concert was given by Conway's Band, of Syracuse, N. Y., after which the floor was cleared for dancing. The new hard-maple floor had an excellent surface and there was plenty of room for all, although more than 2000 were present. Supper was served by a caterer, and here, too, the large crowd was well provided for. Everyone reported a most enjoyable time, and the association—which is an organization for the benefit of sick members—made a handsome profit from the proceeds.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 16, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,014,634. CONVERSATION COUNTER FOR TELEPHONES; K. Born, Kreuzburg, Germany. App. filed Dec. 20, 1910. Operated by the receiver hook.

1,014,662. ELECTRIC HEATER; J. F. Monnot, Paris, France. App. filed Dec. 10, 1910. The heating elements are embedded in the walls of an air flue.

1,014,669. ENGINE STOP MECHANISM; M. and J. H. Raymaker, Sheboygan, Mich. App. filed Dec. 27, 1910. A steam valve is controlled electrically according to the speed of the engine.

1,014,686. INCANDESCENT LAMP; J. Wilson, Victoria, B. C., Canada. App. filed June 4, 1910. The filament support is a reflector.

1,014,692. WALL BASE FOR ELECTRICAL SWITCHES; W. H. Colgan, Newton, Mass. App filed April 5, 1909. Covered screws for fastening the base to a wall.

1,014,704. BRANCH BOX; M. Havens, Jr., Albany, N. Y. App. filed March 24, 1906. Conduit fitting with porcelain cover.

1,014,705. VAPOR ELECTRIC LAMP AND CONNECTION; P. C. Hewitt, New York, N. Y. App. filed March 19, 1903. Arrangement of chamber for condensing the mercury vapor.

1,014,707. SPEED REGULATOR FOR ELECTROMOTORS; B. F. Hutches, Jr., Allendale, N. J. App. filed March 2, 1910. A centrifugal governor controls the current supply.

1,014,718. ELECTRICAL COUPLING; I. H. Parsons, Kibworth Harcourt, England. App. filed March 8, 1910. A snap-on stud and socket.

1,014,719. APPARATUS FOR COLLECTING ELECTRICAL ENERGY; W. I. Pennock, Philadelphia, Pa. App. filed Jan. 4, 1911. Wire gauze suspended by captive balloons, etc.

1,014,720. WIRING BLOCK; E. S. Pereyra, Brooklyn, N. Y. App. filed May 1, 1911. Porcelain support for main and branch circuits.

1,014,722. MEANS FOR VARYING THE PERIOD OF OSCILLATION OF TWO OSCILLATORY CIRCUITS; R. H. Rendahl, Stockholm, Sweden. App. filed Sept. 8, 1909. Tuned system of wireless.

1,014,741. INCLOSED-FUSE INDICATOR; L. E. Barringer and G. Wright, Schenectady, N. Y. App. filed July 9, 1909. Paper treated with potassium chlorate and coated with collodion.

1,014,757. SEAL FOR FUSED-SILICATE CONTAINERS; F. G. Keyes and C. A. Kraus, Boston and Newton Highlands, Mass. App. filed April 10, 1910. The ends are formed of titanium silicate sections of different formulas and coefficients of expansion.

1,014,780. SPOOL HEAD; C. H. Smith, Chicago, Ill. App. filed March 24, 1910. Insulating head with a tapered slot for the wire.

1,014,796. LIGHTNING ARRESTER AND TEST DEVICE; H. E. Wirt, Lewiston, Minn. App. filed March 13, 1911. Grounded plate and bracket inclosed.

1,014,821. ALTERNATING-CURRENT REGULATOR; E. F. Gehrkens, Pittsfield, Mass. App. filed March 2, 1910. Successive sections of a transformer are cut in or out.

1,014,854. ELECTRIC CUT-OUT; H. R. Sargent, Schenectady, N. Y. App. filed Aug. 21, 1911. Thermal plug and contacts.

1,014,875. ELECTRIC-HEATING ELEMENT; F. E. Hewitt, Toronto, Canada. App. filed April 22, 1911. Wire-wound plate for sadirons, etc.

1,014,876. LIGHTNING ARRESTER; W. F. Hiatt, Pittsboro, Ind. App. filed Oct. 27, 1910. Inclosing blocks with inspection of ground gap.

1,014,878. INCANDESCENT-LAMP FILAMENT; G. R. Holmes, Baltimore, Md. App. filed May 6, 1909. Corrugated metal wire.

1,014,882. PROCESS FOR PREPARING RESISTANCE MATERIAL AND THE PRODUCT RESULTING THEREFROM; H. T. Jones, East Orange, N. J. App. filed May 9, 1911. Pure graphite impregnated with carbon.

1,014,892. UNDERGROUND CONDUIT FOR ELECTRIC RAILWAYS; J. C. Mires, Oakland, Cal. App. filed Aug. 24, 1910. Connected box sections for trolleys.

1,014,904. DYNAMO-ELECTRIC MACHINE; E. D. Priest, Schenectady, N. Y. App. filed Aug. 12, 1910. The pole pieces are held in place by flanged resilient plates.

1,014,922. FIRE ALARM; R. Urchniak and G. Werhnjak, Milwaukee, Wis. App. filed May 20, 1911. Thermostat with universal joint connection to the terminals.

1,014,934. INSULATOR KNOB; G. Baker, Torrington, Conn. App. filed Aug. 11, 1910. Two-part porcelain connected by a screw.

1,014,950. FUSE-BLOCK CONTACT POST; R. C. Cole, West Hartford, Conn. App. filed May 16, 1911. Tubular post on a porcelain base.

1,014,965. VAPOR ELECTRIC LAMP AND CONNECTION; P. C. Hewitt, Ringwood Manor, N. J. App. filed March 19, 1903. Inductance for storing and restoring energy in the anode leads.

1,014,966. APPARATUS FOR GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY AND THE CONTROL THEREOF; J. S. Holliday, Wilkinsburg, Pa. App. filed Oct. 26, 1910. Alternating-current generator and motor set for operation of a switch and indicator.

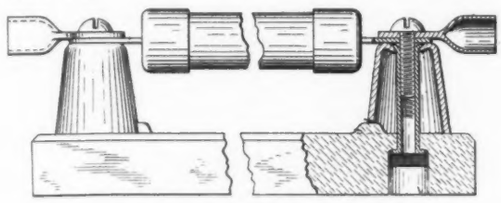
1,015,034. TELEPHONE; J. Lapicki, De Kalb, Ill. App. filed Oct. 25, 1911. A tubular frame support for transmitter and receiver.

1,015,061. AUTOMATIC STEERING DEVICE; A. T. Nelson, Milwaukee, Wis. App. filed Feb. 12, 1906. Magnetic steering gear for boats.

1,015,084. PLUNGER DEVICE; G. H. Rowe, Berwyn, Ill. App. filed Sept. 29, 1911. Rotary and longitudinal movement with a catch; for switches, etc.

1,015,091. APPARATUS FOR MELTING AND MIXING METALS IN VACUUMS; W. S. Simpson, London, England. App. filed May 5, 1911. For aluminum, magnesium, calcium, etc.

1,015,096. SPARK INDICATOR; L. E. Tait, Red Cloud, Neb. App. filed March 14, 1911. Contacts and a yoke for attachment to a spark plug.



1,014,950.—Fuse-Block Contact Post.

1,015,097. SWITCH; E. E. Taylor and D. H. Elkins, Amesbury, Mass. App. filed Sept. 14, 1910. Lever switch for automobile lamp circuits, etc.

1,015,118. THERMOSTATIC ALARM SYSTEM; W. G. Asmus, Cleveland, Ohio. App. filed Dec. 21, 1910. For cars when on sidings or stored and not in use.

1,015,119. THERMOSTATIC CIRCUIT CLOSER; W. G. Asmus, Cleveland, Ohio. App. filed Dec. 21, 1910. A plug which can be made out of a broken lamp stem.

1,015,187. X-RAY OPERATING TABLES; E. W. Kelly, Philadelphia, Pa. App. filed July 27, 1910. Adjustable supports for the X-ray tubes and the plates.

1,015,192. ELECTRIC-CURRENT MEASURING INSTRUMENT; O. A. Knopp, Oakland, Cal. App. filed Feb. 7, 1911. Has an annular core surrounding a conductor of the circuit.

1,015,204. AUTOMATIC TEMPERATURE REGULATOR; M. F. Murray, Oakland, Cal. App. filed Aug. 3, 1910. Solenoid control of hot and cold air valves.

1,015,224. INSULATOR; J. Alsberg, New York, N. Y. App. filed Nov. 18, 1908. Live-wire support with a hood and a safety arcing conductor.

1,015,225. PRESSURE-CLOSED ELECTRIC SWITCH; T. P. Bacon and W. A. Gwynn, Santa Rosa, Cal. App. filed April 26, 1910. indicator and cut-out.

1,015,229. INSULATOR; J. D. Hilliard, Jr., and C. E. Parsons, Glens Falls, N. Y. App. filed Jan. 29, 1906. A built-up insulator of a core and nested insulator shells.

1,015,255. TELEPHONE APPARATUS; D. H. Wilson, Chicago, Ill. App. filed Aug. 7, 1903. A divided coil in circuit.